MYCOLOGIA

OFFICIAL ORGAN OF THE MYCOLOGICAL SOCIETY OF AMERICA

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MYCOLOGIA

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VOL. XL NOVEMBER–DECEMBER, 1948 NO. 6

NOTES ON CERTAIN GASTEROMYCETES, INCLUDING TWO NEW ORDERS [1]

S. M. ZELLER *

These notes have for the most part grown out of the study of type and other material at the New York Botanical Garden [2] and a certain few other types loaned from elsewhere.

HYMENOGASTRALES

1. **Gasterellaceae** fam. nov.

Fructificationes parvissimae, depresso-globosae, epigeae; gleba uniloculata; sporis brunneis, verrucosis.

Fructifications very tiny, depressed globose, epigeous; campanulate development; gleba finally uniloculate, but at times with one circle of cavities formed by vertical, centripetal invaginations which reach the center forming a false columella; cavities lined with a basidial hymenium; spores verrucose, dark.

Type genus: *Gasterella* Zeller and Walker.

This family is erected to take the two uniloculate genera, *Gasterella* and *Gasterellopsis,* while *Protogaster* with coralloid development and smooth spores is retained in *Protogasteraceae.*

[1] Published as Technical Paper No. 535 with the approval of the Director of the Oregon Agricultural Experiment Station. Contribution from the Department of Botany and New York Botanical Garden, Cryptogamic Herbarium, co-operating.

[2] Reference to the New York Botanical Garden Herbarium hereafter in this paper will be by initials only, N.Y.B.G.

* News has just been received that Dr. Zeller died from coronary thrombosis Nov. 4, 1948.

2. CORDITUBERA Hennings in Engler, Bot. Jahrbücher. **23**: 557–558. *f. V–8.* 1897. [Syn. *Hoehneliogaster* Lohwag, Beih. z. Bot. Centralbl. **42** (Abt. 2): 299. 1926.]

We can see no particular reason for the genus *Hoehneliogaster* and thus it is being referred back to synonymy with *Corditubera* whence it came. The differences are more specific than generic. In *C. microspora* upon which Lohwag based his new genus, the basidia-containing lacunae are not quite filled with the netted reticulum of basidia-bearing hyphae, so that toward their centers are left slight cavities, whereas in *C. Staudtii* the lacunae are completely filled. Although the gleba is reddish in one species and yellowish in the other, the genus *Corditubera* is more closely related to *Leucogaster* than to any other genus.

3. The description of *Hydnangium* Wallroth given by Cunningham [3] as emended by Ed. Fischer (Nat. Pflanzen-familien **7a**: 30–31. 1933) is very misleading, especially so where he indicates the "columella dendroid, arising from a well-developed, sterile base," whereas the original description by Wallroth definitely states that a sterile base is *not* present and makes no mention of a columella. Fischer's description too was misconstrued and erroneously stated; thus Cunningham thought he might have reason to relegate Cavara's *Arcangeliella* to synonymy with *Hydnangium.* The facts are that Fischer presented informal taxonomic descriptions and actually pointed out a contrast between *Hydnangium* and *Arcangeliella;* that whereas in a species like *Hydnangium carneum,* the type of the genus, in which its primordial stages *only* have a columella, *Arcangeliella* retains the columella and pileate peridium to maturity.

After having collected and examined in the field and in the laboratory many specimens in both of these groups we are in agreement with Fischer on the relationships between *Arcangeliella* and *Hydnangium* and will abide by the published treatment of these two genera and *Octaviania.*[4]

[3] Cunningham, G. H. The Gasteromycetes of Australia and New Zealand. See p. 63. 1942.

[4] Mo. Bot. Gard. Ann. **23**: 574–575; 602–605. 1936.

4. **Hydnangium nigrescens** sp. nov.

Fructificationes 2.5–4 × 1–3 cm. crassae, oblongae vel subglobosae, rhizomorpho affixae; superficie glabra, molli, alba dein nigrescente; fibrillis paucis, ad superficiem inferiorem applanatis; peridio simplici, 130–150 μ crasso, siccato 45–60 μ crasso, hyphis hyalinis magnis circa 7.5–9 μ crassis implicatis composito, superficie fuscata; gleba brunnea; locellis medii-magnitudinis; septis tenuibus, albis, hyphis compactis parallelibus compositis, circa 60–85 μ crassis (hymenio annumerato); basidiis 2-sporigeris; sporis subglobosis, 12–16 μ, pedicellatis, obscure brunneis, uniguttulatis, episporio crasso, verrucoso, verrucis magnis, 10–12 circumferentiam quamquam ornantibus.

Fructifications oblong to subspherical, about 2.5–4 cm. × 1–3 cm., attached by a single rhizomorph; surface soft, glabrous, with some innate veins especially below, white becoming black on oxidizing, drying fuscous black; peridium 130–150 μ thick when fresh, drying 45–60 μ thick, spongy, composed of large loosely woven, hyaline hyphae, about 7.5–9 μ in diameter, the surface hyphae dark, forming a slightly more compact rind; gleba brown, drying Prout's brown; cavities relatively large; septa white, drying papery thin, of compact, parallel hyphae, about 60–85 μ thick (including hymenia); basidia 2-spored; spores subglobose to slightly ellipsoid, sometimes with remains of the stout sterigma, 12–16 μ in diameter, dark brown with one large vacuole, epispore thick, rough with very large blunt verrucae, 10–12 per circumference.

Partially exposed on the ground in mixed woods. **Type** collected in Cornell Plantations along Fall Creek, east of Floriculture Gardens, Tompkins county, New York, *C. T. Rogerson,* No. 1615, August 18, 1947. (In Cornell University, Plant Pathology Herb. No. 37257, and also in Zeller Herb.)

H. nigrescens has spore markings like those of *H. purpureum* but the spores are larger. It also differs in peridial characters, especially color, thickness, and size of hyphae.

5. **Hydnangium vesiculosum** (Coker & Couch) n. comb. (Syn. *Gymnomyces vesiculosus* Coker & Couch, Gasteromycetes of Eastern U. S. and Canada, p. 23. 1928.)

Fructifications subspherical, about 1 cm. diameter, drying to about half size, attached by a few basal fibrils which spring from a narrow depression; surface light buff yellow (about Naples yellow), spongy; peridium at first thin, of delicate, loosely woven, yellowish hyphae, quite evanescent, nearly absent at maturity, ex-

posing the gleba in places; gleba pallid gray-brown (pale earthy buff), firm but pliable, not tough or elastic; cavities rather large and box-like, empty, about 0.4–0.8 mm. in diameter; septa about 0.17–0.2 mm. thick including the hymenia which are about 30 μ thick, composed of large bladdery cells (pseudoparenchyma) about 20–40 μ thick except for a very thin layer under the hymenium where the cells are small; basidia short, thick, 4-spored; sterigmata nearly half as long as the spore diameter; spores concolorous with gleba, spherical, 7.5–10 μ including the strong blunt spines, often stuck together in groups of 4, sometimes finely reticulate.

Type locality: Chapel Hill, North Carolina.

Habitat: Exposed by erosion on soil in frondose woods.

Distribution: Known from type locality only.

Illustrations: Coker & Couch, Gasteromycetes of Eastern U. S. and Canada. *pls. 16, 17, 105, f. 17–19.*

As stated previously there is no sound basis for retaining *Gymnomyces* since all the species have a peridium, even though it may be evanescent. The same argument holds for the retention of *Chamonixia* as separate from *Gautieria* since most, if not all, species of the latter have an evanescent peridium.

The species *Gymnomyces vesiculosus* is, therefore, transferred to *Hydnangium*. The spores are sculptured as described by Coker & Couch but they also have very fine reticulations which seem *not* to be at all raised (alveolate).

6. **Elasmomyces Rodwayi** (Massee) n. comb. (Syn. *Secotium Rodwayi* Massee, Kew Bull. Misc. Info. **1901**: 158. 1901.)

A part of the type collection from the Herbarium of George Massee is at the N.Y.B.G. The spores are subglobose, distinctly echinulate with blunt spines and also reticulate with large meshes, practically hyaline, short pedicellate, and 9–11 μ in diameter.

7. MACOWANITES Kalchbrenner, Hedwigia **15**: 115. 1876; Grevillea **10**: 107. 1882. [*Macowania* Kalchbrenner, Gardeners' Chron., N.S. **5**: 785. 1876, *non Macowania* Oliver in Hooker, Icon Pl. III **1**: 49. 1870.—*Hypochanum* Kalchbrenner, Gard. Chron., N.S. **6**: 140. 1876. *nomen nudum.*]

As was indicated previously [5] the spores of *MacOwanites agaricinus* Kalchbr. are borne "asymmetrically on the sterigmata as in

[5] Zeller, S. M., and C. W. Dodge, Ann. Mo. Bot. Gard. **23**: 636–637. 1936.

the Hymenomycetes." This matter has just been studied again and the part of the type in the herbarium of the N.Y.B.G. proves to be part of an aberrant Agaric belonging perhaps to *Russula*. The spores are slightly ellipsoid, echinulate, pedicellate with the sterigmatal scar asymmetrical to the main axis of the spore. There is also pseudoparenchyma in the tramal tissues as well as in the pileate tissue. According to nomenclatural procedure the genus is rejected and other species which have been assigned to this genus are disposed of as follows:

MacOwanites magnus Parks has lactiferous ducts in the sterile tissues and is like *Arcangeliella* in general morphological development. It, therefore, becomes **Arcangeliella magna** (Parks) n. comb. and *M. alpinus* Zeller is recombined as **Elasmomyces alpinus** n. comb.

8. GYMNOGLOSSUM Massee, Grevillea **19**: 97. 1891. (Syn. *Dendrogaster* Bucholtz, Hedwigia **40**: 316–318. 1901.)

Study of a part of the type collection of *Gymnoglossum stipitatum* Massee in the herbarium of N.Y.B.G. reveals that Cunningham's[3] reduction of *Dendrogaster* to synonymy is justified. The specimen examined has smooth spores, however, as Massee reported. They are 13–16 × 6–8.5 μ, definitely citriform with a very small apiculus and sometimes with a short pedicel. Since *Dendrogaster* is thus reduced to synonymy the following new combinations are necessary, **Gymnoglossum majus** (Z. & D.), **G. megasporum** (Z. & D.), **G. cambodgense** (Patouillard), **G. candidum** (Harkness), **G. radiatum** (Lloyd), **G. connectens** (Bucholtz), **G. utriculatum** (Harkness), **G. globosum** (Harkness), **G. foetidum** (Coker & Couch), **G. olivaceum** Zeller, and **G. elasmomycetoides** Zeller.

HYSTERANGIALES

1. PROTUBERA Möller, in Schimper, Botanische Mitteilungen aus den Tropen **7**: 10–22: 145. *T VI, f. 1–10.* 1895. (Syn. *Protophallus* Murrill, Mycologia **2**: 25. 1910.)

There are two dried collections of *Protubera Maracuja* Möller in the Cryptogamic Herbarium of the N.Y.B.G., both ex Farlow

[3] l.c. See p. 71.

Herb., Harvard University and both collected by Rev. J. Rick as follows: Rick Fungi Austro-Americani, No. 36, taken at Sao Leopoldo, 1904, and Rick Expeditions in Brazil, No. 136, taken at Parecy Novo, Rio Grande do Sul, 1928. Both collections answer very closely Möller's description of *P. Maracuja*. After the fructifications were soaked in water for 10–12 hours the character and organization of the essential parts were readily observed. There were found but two minor differences between *Protubera* and *Protophallus* Murrill. The one is hypogeous, the latter epigeous, and the former has a columella branched from the base or point of attachment. In the two species of *Protophallus* the columella is simple, extending to the center of the fructification and from its summit the tramal plates radiate. Such differences are more specific than of generic rank and it would seem wise to unite the two genera and transfer the two species of *Protophallus* to *Protubera* as **Protubera jamaicensis** (Murrill) n. comb. and **P. brunnea** Zeller n. comb.

P. Maracuja and *P. brunnea* are quite closely related but they differ in color, and characters of columella and spores. *Protubera* and *Calvarula* will be retained as members of the family *Protophallaceae*.

PHALLALES

1. CLATHRUS Persoon, Syn. Meth. Fung. p. 241. 1801. (*Dycticia* Rafinesque in Desraux, Jour. Bot. **2**: 176. 1809.—*Clathrus* sect. *Clethria* Fries, Syst. Myc. **2**: 288. 1823.—*Ileodictyon* Tulasne, Ann. Sci. Nat. Ser. III **2**: 114. 1844.—*Clathrella* Fischer, in Engler & Prantl, Nat. Pflanzenfam. **1**: [Ab. 1**] 284. 1898.)

It is with some hesitancy that *Clathrella* Fischer is placed in synonymy with *Clathrus*, but there seems to be only one real distinction besides size to separate them, namely the longer meshes on the sides compared with those over the top of the receptacle of *Clathrella* while in *Clathrus* these meshes are more or less the same size throughout. Also the drawn-out stem-like base in some individual plants of *Clathrella* is not a constant character and may be as conspicuous in some individuals of *Clathrus* as in individuals of *Clathrella*. It may or may not be present in all plants of a single collection according to Cunningham.[2]

[2] l.c.

Ileodictyon was proposed by Tulasne to receive those species of *Clathrus* with tubular, not chambered, arms of the receptaculum. Here again, Cunningham has found that "the type species, *Clathrus cibarius,* contains plants with both tubular and cellular arms, small plants as a rule possessing tubular, and large ones, cellular arms." Cunningham is, therefore, followed in grouping species of *Clathrella* and *Ileodictyon* under the genus *Clathrus.*

2. LYSURUS Fries, Systema Mycologicum **2**: 285–286. 1823. (*Anthurus* Kalchbrenner & MacOwan in Kalchbrenner & Cooke, Australian Fungi, Grevillea **9**: 2. 1880.—*Aserophallus* Lep. & Mont. Ann. Sci. Nat. [Ser. 3] **4**: 360. 1845.—*Mycopharus* Petch, Brit. Myc. Soc. Trans. **10**: 281. 1926.—*Pharus* Petch, Bot. Gard. Peradeniya, Ann. **7**: 59. 1919.—*Lysurus* sect. *Desmaturus* Schlechtendal in Linnaea **31**: 180. 1861–62.)

Peridium duplex, outer layer thin and furfuraceous, inner thick, gelatinous, remaining at the base of the stem as a volva at maturity; receptacle a hollow cylindrical or flaring stem, carrying at its summit a number of simple arms apically free or united organically or by a delicate membrane, continuous with or somewhat distinct from the stem below; gleba borne on the inner surfaces and sides of the arms, olivaceous, mucilaginous, foetid; spores smooth, phalloid.

Type species: *Lysurus Mokusin* (Pers.) Fries.

The similarity between *Lysurus* and *Anthurus* has been discussed by Cunningham.[3] Early workers as well as workers of today have not been certain of the taxonomy of these two genera, and since the type specimen upon which Kalchbrenner & MacOwan erected the genus *Anthurus* no longer exists and the original description of *Anthurus* could just as well apply to *Lysurus, Anthurus* is reduced to synonymy. We cannot agree with Cunningham that *Pseudocolus* Lloyd is synonymous with *Anthurus* or *Lysurus.* It stands apart as a genus in which the arms of the receptacle are long and narrow and united at the apex.

The species that have been assigned either to *Anthurus* or *Lysurus* have at one time or another usually been referred to both genera so there are few if any new combinations to be made by the union of the two under the name *Lysurus.* There are three spe-

[3] l.c. See pp. 101 and 104.

cies in North America, namely, *Lysurus Gardneri* Berkeley, London Jour. Bot. **5**: 535. 1846, *Lysurus Mokusin* (L. ex Pers.) Fries, Syst. Myc. **2**: 286. 1823, and *Lysurus pusillus* Coker, Mycologia **37**: 781–783. 1945.

3. KUPSURA SPHAEROCEPHALA Lloyd, in Lloyd, Myc. Writ. **7**: 1303. *f. 2903–2904.* Oct. 1924.

The type specimen (No. 24893) (kindly loaned by Dr. J. A. Stevenson), upon which Lloyd based the genus *Kupsura,* proves to be a very mature, softened specimen of *Simblum sphaerocephalum* Schlechtendal. When the specimen was fresh the stem of the receptacle had been crowded up into the head and it was dried in that condition. This was misleading to Lloyd who took the brown interior (receptacle) of the head to be brown glebal tissue. Misleading also is a portion of the volva which remained over the top of the latticed head. *Kupsura* Lloyd thus becomes a synonym of *Simblum.*

4. STAHELIOMYCES CINCTUS Ed. Fischer, Mitteil. Nat. Ges. in Bern **1920**: XXXV and 137. 1921.

This genus has been reported previously from British and Dutch Guiana. There is a very good pencil sketch made by A. F. Porter, Decorah, Iowa, of a specimen about 9 inches tall and 1.5 inches broad which he found in a dense jungle forest on the Bobanaza River, near Saryacu [Curicucha], Eastern Ecuador. The sketch is in the N.Y.B.G. Herb. This extends the known range fairly well across northern South America. There is no mistaking the identity of the fungus from which the sketch was made.

Somewhat more difficult, however, is the identification of the fungus from which was made a water-color painting to be found in the Ellis Collection at the same herbarium. Under the sketch in Ellis' handwriting is *"Corynites Ravenelii* B. & C. from Miss Lizzie Berk Hancock, Burlington, N. J., Autumn, 1881." The illustration is of a volvate fungus with reddish receptacle like a *Mutinus* (Syn. *Corynites*) but with the gleba in a zone around the receptacle some space below the apex, the tip of which had evidently been broken off. There was not the usual constriction of the receptacle at the glebal band as in *S. cinctus.* The plant evidently had all of the characters of *Staheliomyces* but if the re-

ceptacle was red and there was no constriction of the latter at the glebal zone it may have been a distinct species. There is a question, therefore, as to the species; and was the painting made from a specimen actually collected in New Jersey?

5. ITAJAHYA GALERICULATA Möller, in Schimper, Bot. Mitt. aus den Tropen **7**: 79. *pl. 5.* 1895.

Our knowledge of the genus *Itajahya* in the United States is greatly enhanced by the careful field notes and compilations of the late Dr. W. H. Long[6] and his co-operators. He has reported the genus from Texas, New Mexico, and Arizona. In the herbarium of the N.Y.B.G. is a specimen of *Itajahya galericulata* collected by E. Bethel near Denver, Colorado. There are no further collecting data with the specimen.

LYCOPERDALES

1. The *Lycoperdaceae* of the past has been more or less a catch-all for any gasteromycete having capillitium and so it seems best to divide the family as presented by Fischer (**1933**) into more unified entities. The genera with stromate fructifications have been referred to the new family *Broomeiaceae* and those with spiny capillitium are included in the new family *Mycenastraceae.*

Broomeiaceae fam. nov.

Fructificationes stromatae ovoidae vel subglobosae; peridio duplici, exoperidio tenui subevanescenti, endoperidio membranaceo, stomatibus; capillitio simplici.

Fructifications single or many on a stroma, mostly ovoid, hemispheric or subspheric; exoperidium thin, wholly or partly disintegrated at maturity, endoperidium papery or thickish, laid bare at maturity, opening by an apical pore; capillitium present, threads more or less symmetrical, simple.

This family was created to care for the three genera with stromate fructifications, *Broomeia,* with a stalked stroma, *Diplocystis,* with a resupinate or patellate stroma, and *Lycogalopsis* in which the fructifications are borne singly on a stroma. Fischer (**1933**)

[6] Long, W. H., and D. J. Stouffer. The genus *Itajahya* in North America. Mycologia **35**: 620–628. *Illus.* 1943.

questioned whether these genera should be included in the Lycoperdales at all, but I am referring the *Broomeiaceae* to this order.

Mycenastraceae fam. nov.

Fructificationes magnae, subglobosae; peridio duplici, exoperidio crasso, spongioso, glabro vel areolato, endoperidio crasso coriaceoque vel tenui tenacique, demum irregulariter dehiscenti; capillitio ramoso, spinoso; sporis globosis vel ellipsoideis, verrucosis.

Fructifications large, subglobose; peridium duplex, exoperidium thick, spongy, smooth or areolate, endoperidium thick and leathery or thin and membranaceous; capillitium branched with short, pointed, spine-like branches; spores globose to ellipsoid, verrucose.

This family is proposed to contain the genera *Mycenastrum* and *Calbovista*.

2. LYCOPERDON ALBINUM Cooke, in Massee, Jour. Roy. Microsc. Soc. **1887**: 723. Oct. 1887.

Lloyd[7] must have applied from memory Cooke's name of this fungus to Porto Rican collections made by John A. Stevenson and used the misnomer *L. albidum* instead of *L. albinum*. A slide (No. 58690) in the Lloyd Herbarium prepared by Lloyd from the type of *L. albinum* Cooke has been studied and it appears that Mr. Lloyd was justified in referring the Porto Rican collections to this species. Lloyd and Cooke, however, made the same mistake; the spores are finely asperate instead of smooth. An emended description follows:

Fructifications 4–12 mm. in diameter, subspherical to pyriform, sessile, yellowish with a whitish bloom, smooth to slightly checkered by tiny cracks; peridium thin, somewhat farinose, yellowish; gleba yellowish then turning grayish; capillitium scanty, hyaline, slender, flaccid; spores spherical to somewhat irregular, slightly asperate, almost hyaline, 2.5–4.2 μ.

Type locality: Brazil, South America.
Habitat: On rotted wood or on humus in soil.
Distribution: Puerto Rico and Brazil.
Illustrations: Lloyd, Myc. Writ. **5**: 582. *f. 822.* 1916.

[7] Lloyd, C. G., Myc. Writ. **5**: 582. *f. 822.* 1916.

3. COILOMYCES SCHWEINITZII Berk. & Curtis.

A study of the type of this genus and species, which is to be found in the Herbarium at N.Y.B.G., verifies Fischer's [8] assumption that this genus was based on a collection of *Geastrum mirabile* Mont. from Surinam. The central cavity to which the authors referred and upon which the generic name was based is where the relatively large columella had collapsed. The Berkeley and Curtis specific name predates Montagne's name and necessitates the following new combination:

Geastrum Schweinitzii (Berk. & Curtis) Zeller n. comb.

Coilomyces Schweinitzii Berk. & Curtis, Jour. Acad. Nat. Sci. Philadelphia (Series 2) **2**: 279–280. 1853.

Geastrum mirabile Mont., Ann. Sci. Nat., Ser. IV **3**: 139–140. *pl. 6, f. 8.* 1855.

Geaster papyraceus B. & C., Am. Acad. Arts & Sci. Proc. **4**: 124. 1858.

Geaster lignicola Berk., Linn. Soc. Bot. Jour. **18**: 386. 1891.

Geaster caespitosus Lloyd, Myc. Writ. **2**: 315. *pl. 100.* 1907.

4. **Bovistella atrobrunnea** sp. nov.

Fructificationes depresso-globosae vel turbinatae, superne saepe collapsae, 3–4 cm. crassae, 2–3 cm. altae, rhizomorphis affixae; superficie impolitae leves vel leniter furfuraceae vel leniter rimosae, siccitate obscure brunneae; exoperidio tenui, fragili, superne squamis facile separabilibus discedisque vestito; endoperidio tenuissimo papyraceoque, impolito- vel nitido-glabro, apice osculo laciniato dehiscente; basi sterili cellulosa, convex inscula, nitido-brunnea septis instructa; gleba pulverulenta obscure vinaceo-brunnea vel obscuriora; capillitio discreto, longo, paulo ramoso, terminalibus longis attenuatis tenuioribusque, obscure brunneo; sporis brunneis, sphaericis, verrucosis, 5–8 μ, longe pedicellatis.

Fructifications oblate spheroid to turbinate, often collapsed above, 3–4 cm. broad, 2–3 cm. high, with a prominent attachment but not particularly radicate; surface dull, smooth to somewhat furfuraceous, somewhat rimose, dark brown (dry); peridium duplex, exoperidium thin, brittle, breaking up into small plates which easily separate and fall away; endoperidium very thin, papery, dull to shiny, a little lighter colored than the exoperidium, dehiscing by a torn irregular apical pore; sterile base prominent, somewhat convex above, occupying one-third to one-half of the lower portion of the fructification, of large cells, separated by thin, shiny, metallic-brown walls; gleba pulverulent, dark vinaceous brown or darker; capillitium free, long, slightly branched

[8] Fischer, Ed. Gasteromycetes, in Engler and Prantl, Die Nat. Pflanzenfam. **7a**: 1–122. 1933. (See p. 76.)

or simple, with long tapering narrow (or even thread-like) terminals, dark brown, somewhat uneven; spores brown, spherical, verrucose, 5–8 μ, with a hyaline pedicel up to 30 μ long which is easily broken away.

On the ground, Ann Arbor, Michigan, October 6, 1936, *A. H. Smith,* 5048a, **type** (in U. Mich. Herb., portion in Zeller Herb.).

Bovistella atrobrunnea differs from other species of the genus in the very dark gleba, the spherical, verrucose spores and particularly in the capillitium. The latter is nearly simple but, now and then, dichotomously branched and the branches or terminals are tapering or drawn out to very long, narrow thread-like filaments very much narrower than the main stem of each unit of capillitium. It is named for the very dark brown gleba.

5. **Morganella** gen. nov.

Fructificationes parvae, subglobosae; peridio duplici, apice ore dehiscente; gleba pulverulenta, capillitio tenuissimis membranisque ad basim radiantes; sporis sphaericis, coloratis.

Fructifications small, subglobose; peridium duplex, dehiscing by an apical stoma; gleba pulverulent, with capillitium and filmy membranes radiating from base to peridium; spores spherical, colored.

Type species *Morganella mexicana.*

Morganella mexicana sp. nov.

Fructificationes parvae, subglobosae, solitariae vel caespitosae, appendici radiciformi albo adfixae; peridio duplici; exoperidio furfuraceo, brunneo, in squamas furfuraceas fisso; endoperidio papyraceo-tenui, apice ore irregulari dehiscenti; basi sterili inconspicua, contextu flavido solidiusculo sine locello composito; gleba pulverulenta, pallido-grisea vel pallido-brunnea, tenuissima membrana et capillitio sporisque composita; membranae hyalinae, ut bullatis sacculis instructis, atque notis lunulatis appareant; capillitio hyalino, laevi, paulo ramoso; sporis rubro-brunneis, sphaericis, paulo verrucosis, 3.7–4.3 μ.

Fructifications from a white, mycelial rhizomorph, small, subglobose, single or caespitose; peridium duplex; exoperidium furfuraceous, becoming separated over the endoperidium in the form of tiny furfuraceous squamules, bay or natal brown becoming hair brown; endoperidium thin, papery, dehiscing by an apical irregular rupture; gleba with a very slight sterile base which is of yellowish solid tissue without apparent chambers, fertile portion pulverulent, pale gray, becoming light chocolate brown, composed at maturity

of very filmy membranes (in which capillitium is enmeshed) radiating from the base to the endoperidium and spores; membranes hyaline, with tiny pockets and swellings appearing as crescent-shaped markings; capillitium threads (embedded in the filmy membranes) hyaline, smooth, very slightly branched; spores reddish brown, spherical, slightly verrucose, 3.7–4.3 μ.

Type locality: Near Guaymas, Sonora, Mexico.

Habitat: In wet places among moss and leaves.

Distribution: New Jersey, Mexico, Panama, and Colombia.

Specimens examined: New Jersey: Newfield, Aug. 1887, *J. B. Ellis,* No. 5013 (in N.Y.B.G. Herb.); Mexico: Sonora, near Guaymas, *Thomas H. Macbride,* **type** (in Morgan Herb. at University of Iowa); Panama: Canal Zone, Ft. Sherman Area, *G. W. Martin,* No. 6183; and South America: Colombia, Sierra Nevada de Santa Marta, Dept. Magdalena, Hacienda Cincinnati, *G. W. Martin,* No. 3440 (both in Mycological Collections of the University of Iowa).

In the N.Y.B.G. Herbarium there is correspondence between Thomas H. Macbride, J. B. Ellis, and A. P. Morgan relative to the collection of this fungus taken by Macbride in Mexico and to which the collector had given the tentative name *Lycogala mexicanum.* The following letter from A. P. Morgan to Macbride seems worth quoting:

"That is a queer thing you sent me, but I think it is a puffball —*Lycoperdon.* I cut it in two and scanned it internally and externally. The peculiar membrane with disk-like markings certainly resembles the membrane of Myxomycetes, it is very thin and irridescent, but the spores are those of a puffball. I managed to get off some bits of the rind, which I consider to be made up of true hyphae; I enclose them to you. The threads of the capillitium are unlike those of ordinary puffballs; but there are two puffballs that have similar threads and they have bits of membrane adhering to them in the same way; these are *Lycoperdon Curtisii* Berk. and *L. acuminatum* Bosc. Of course the membrane is not as marked a feature as in this specimen.

"But what is more, in cutting down through the peridium I arrived at a slender rooting mycelium, a thick strand of hyphae in it. Tear this up or mark it with the point of a knife blade and

you can see the hyphae comprising it plainly with about 500 diameter.

"I am quite sure that it is a *Lycoperdon,* but it is nothing I have ever seen before."

This truly is a most interesting Gasteromycete which belongs in the *Lycoperdaceae* or the *Mesophelliaceae.* Until more is known of the origin and development of the membranes in the fertile gleba it is placed in the *Lycoperdaceae* for convenience. It seems possible that the membranes mentioned above may originate from a very thin tramal tissue between the hymenia of the septa. The origin of the pockets and swellings in the membranes is beyond our present understanding.

Morgan's mention of membranes in the gleba of *Lycoperdon Curtisii* Berk. and *L. acuminatum* Bosc. is unexplainable unless he was dealing with very young specimens in which the tramal tissues are just breaking down. Such membranes, however, seem unrelated to such as found in *Morganella* at maturity.

At late maturity of *Morganella* the whole gleba disappears, leaving a more or less cupulate or discoid, empty peridium, exposing the silvery gray inner surface of the endoperidium.

6. **Radiigera cinnamomea** sp. nov.

Fructificationes 1–3 cm. crassae, depresso-globosae vel turbinatae, basi saepe radicanti; superficie cinnamomea, squamis minutis, concoloribus, saepe apice conniventibus obsita; basis sterilis superne convex inscula, inferne attenuata, cellulis parvis composita; columella conica vel subglobosa, mollospongiosa compacta, concolor; peridio duplici 0.5 mm. siccato; exoperidio squamoso; endoperidio suberoso, fragili siccato, 250–300 μ crasso; gleba cinnamomea, fasciculis hypharum capillitioque sporisque composita; capillitio ad columellam percursum radians hyalino molli, flexuoso, inaequali, 6–7 μ crasso; sporis pallidissine-brunneis, sphaericis, sparse-echinulatis, pedicellatis, 3.75–5 μ crassis, non guttulatis.

Fructifications 1–3 cm. diam., depressed globose to turbinate, with a slightly projecting basal attachment; surface dull cinnamon brown, with minute indistinct, concolorous, sometimes connivent scales; sterile base very slightly convex above, somewhat attenuate below, cells small but distinct, crowned by a broad subspherical to conical columella which occupies about one-half of the central portion of the fructification; columella concolorous with the gleba, composed of a compact, soft, pithy, homogeneous (?) tissue; peridium duplex, total drying about 0.5 mm. thick, exoperidium scaly

as described above, endoperidium corky, brittle, about 250–300 μ thick; gleba cinnamon brown throughout, composed of fascicles of hyphae and capillitium radiating from the surface of the columella to the inner wall of the endoperidium, readily separating from the former on drying; capillitium hyaline, various sizes of filaments up to 6–7 μ in diam., soft flaccid, sometimes with very filmy remains of hyaline membranes adhering; spores very dilute brownish, almost hyaline, spherical, minutely and sparsely echinulate, 3.75–5 μ, with a long flexuous (collapsed) pedicel, not guttulate.

Type locality: Near Philadelphia, Pa., collected by *T. G. Gentry*, **type** (in N.Y.B.G. Herb. and portion in Zeller Herb.).

Distribution: Known from type locality only.

SCLERODERMATALES

1. SCLERODERMA AUREA Massee in Cooke, Grevillea **18**: 26. 1889.

One-half of a specimen in the N.Y.B.G. Herb. is labelled in George Massee's handwriting as follows: "Scleroderma aurea, Mass., New Guinea, TYPE." It is a small-spored form of *S. aurantium* Pers. The spores are globose, alveolate-reticulate-echinulate, 6.3–7.5 μ. The echinulae are quite long and acute.

2. SCLERODERMA COLUMNARE Berkeley & Broome, Ceylon Fungi No. 726.—*Areolaria columnaris* (Berk. & Br.) DeToni in Sacc. Syll. Fung. **7**: 144–145. 1888.

A supposedly authentic specimen from Ceylon purchased from George Massee by the New York Botanical Garden is the short stipitate form of *Scleroderma verrucosum* Pers. Cunningham referred *S. columnare* to *S. Bovista* and Lloyd referred it to *S. cepa*. The latter is more nearly correct since the spores are not reticulate. The spores are bluntly echinulate, the peridium warted, and otherwise the specimen appears like *S. verrucosum*.

3. SCLERODERMA LYCOPERDOIDES Schw. Schrift. Naturf. Ges. Leipzig **1**: 61. 1822.—*Scleroderma tenerum* B. & C. Cuban Fungi No. 512.

The type collection of *Scleroderma lycoperdoides* Schweinitz is in the Ezra Michener Collection, Vol. 17, Sheet No. 37 (U.S.D.A., Bureau of Plant Industry, Mycological Collections, Beltsville,

Maryland). The collection is labelled "No. 2242, Syn. Fung. *Scleroderma lycoperdoides* Schw., on the earth, Carolina (ex Herb. Schw.)." This specimen has spores with closely set acute spines and they average about 12–14 μ. It seems in every respect like *S. tenerum* B. & C.

4. SCLERODERMA TUBEROIDEUM Speg. Anal. Mus. Nac. Buenos Aires **16**: 28. 1906.

An authentic specimen of this species sent by Spegazzini to the N.Y.B.G. proves to be *S. cepa* Pers.

5. ASTRAEUS HYGROMETRICUS (Pers.) Morgan is a cosmopolitan species throughout temperate climates. The species is quite variable in surface characters of the exoperidium. There are smooth, even glossy specimens, others that are rough and felty, while still others are fibrillose scaly. Otherwise there seems to be little variability except in size.

One collection taken by *O. E. Jennings,* in sand dunes, Presque Isle, Erie county, Pennsylvania (in Herb. Carnegie Museum, Pittsburgh), is a very smooth form to which a great deal of study has been given and merits further attention. The peridium has the same structure as that of typical *A. hygrometricus,* but when soaked in water the exoperidium does not dehisce along well-marked sutures radiating from the apex. On the contrary it cracks along irregular lines. If other collections may be found to show the same tendencies this form could hardly be included in *Astraeus.*

6. **Astraeus pteridis** (Shear) comb. nov. (*Scleroderma pteridis* Shear, Bull. Torr. Bot. Club **29**: 451. 1902.—*Geastrum hygrometricum* Pers. var. *giganteum* Lloyd, Myc. Writ. **1**: 68. *f. 30.* 1901.)

Most of the years since 1909 I have spent in western Oregon or Washington and have wondered why *Scleroderma pteridis* Shear could not be found. Recently a portion of the type was discovered at N.Y.B.G. It proved immediately to be an old acquaintance, the "Giant *Astraeus*" of the Pacific northwest. It is not unusual to find the buttons up to 2 inches in diameter. The largest expanded star observed was over 9 inches. Shear men-

tioned its similarity to *Scleroderma geaster*. It is in size only. The peridial characters are entirely distinct.

7. CALOSTOMA MICROSPORUM Atkinson, Jour. Myc. **9**: 16. 1903. Emended description:

Fructifications 4–7 cm. high; foot stalk 3–6 cm. × 1–1.5 cm., cylindrical or ventricose or enlarged below, sometimes compressed, rarely two or more footstalks joined throughout the length; endoperidium ovoid, 10–15 mm. broad, slaty or bluish gray to warm brown, mouth stellate with 5–7 prominently raised teeth, vermillion colored on their inner faces; exoperidium separating into numerous small, hard, adherent warts covering the middle and lower surface of the endoperidium and usually entirely wanting toward the apex where the endoperidium is quite smooth; spore sac pure white; spores pure white, smooth, oblong, some rarely ellipsoid, 6–10 × 3.5–5 μ. Type locality: Rugby, Tennessee.

The type collection was kindly loaned by Dr. H. M. Fitzpatrick, and Atkinson's description has been emended to conform with other descriptions presented here. There are to us three outstanding characters of the species: The small ellipsoid spores which show little variability in size and shape, the very prominently raised peristome, and the prominence of the exoperidium left as warts on the sides of the endoperidium. The spores and the spore sac are also characteristically pure white.

A collection by L. W. Nuttall taken from wet mossy banks in Fayette county, West Virginia, extends the range. This collection predates the collection of the *type* by nine years. It was distributed as No. 881, Flora of Fayette county, West Virginia, collected by L. W. Nuttall, March 25, 1893. In this collection the endoperidium is warm brown while in the type collection it is slaty or bluish gray.

8. **Sedeculaceae** fam. nov.

Fructificationes coriaceae, sine basi sterili nec radicibus; peridio crasso, superne coriaceo, inferne paene obsoleto dehiscentique; gleba pulverulenta, cum venis crassis, a peridio ad centrum vergentibus; sporis brunneis, breve pedicellatis.

Fructifications leathery, without sterile base or radicle; peridium thick, leathery above, almost obsolete and dehiscing below; gleba becoming powdery at maturity, with broad veins extending in-

ward from the peridium; spores brown, pedicellate or with sterigmatal scar.

From the specimens so far examined it is evident that *Sedecula* develops centripetally and has complete reduction of stipe and sterile base. There is practically no sterile tissue remaining over the lower surface of the fructification where the gleba is almost if not usually naked. The genus was first placed for convenience in the *Sclerodermataceae* (Mycologia **33**: 212. 1941) merely because of the heavy, leathery peridium. The sterigmatal scar or pedicellate character of the spores indicates closer relationship to *Pompholyx* than to *Scleroderma,* but because of the evidence of centripetal development it is here placed in a family by itself. *Sedeculaceae,* so far containing *Sedecula* only, is referred to the Sclerodermatales.

NIDULARIALES

1. SPHAEROBOLACEAE. The chief recent contributions to our knowledge of this family have been made by Walker [9] and Greis.[10]

Walker has found two distinct types, *Sphaerobolus stellatus* Tode and *S. iowensis* Walker. Both of these species have the lacunar type of glebal development in which large buffer cells or space formers expand the glebal chambers before basidia are formed. In *S. stellatus* the basidia grow into and fill these spaces forming nests of basidia, as in the *Melanogastraceae* and *Sclerodermataceae.* (See Zeller, S. M., Developmental morphology of Alpova. Oregon State College Monographs in Botany No. 2. *illus.* 1939.) In *S. iowensis* the basidia form hymenial linings to otherwise hollow chambers. There are other differences. There is a gelatinous layer in the peridium in *S. stellatus,* not in *S. iowensis,* while the gleba of the latter dries soft or gluey and gelatinous and that of *S. stellatus* dries firm and hard.

Greis found a form of *S. iowensis* in Europe which he called forma *europaea.* In addition he has described the genus *Nidulariopsis.* The fruiting body here rises from a mycelial cord and

[9] Walker, Leva B. Development and mechanism of discharge in *Sphaerobolus iowensis* n. sp. and *S. stellatus* Tode. Jour. Elisha Mitchell Sci. Soc. **42**: 151–178. *pl. 16–25.* 1927.

[10] Greis, H. *Nidulariopsis melanocarpa* Greis nov. gen. nov. spec. und eine neue Form von *Sphaerobolus iowensis.* Hedwigia **75**: 255–266. *illus.* 1935.

the gleba is like that of *Sphaerobolus iowensis* with cavities lined with an even basidial hymenium. He says a special peculiarity is that the middle layer of the peridium consists of rounded brownish cells with thick walls, and this layer does not reach across the summit of the fruiting body. But this peculiarity was recognized by Lohwag [11] who believed that this layer indicates a cup-shaped primordial (tramal cup) development. Walker's illustrations of *S. iowensis* (*Pl. 17, f. 11 & 13*) show this interrupted middle layer very plainly.

It appears that any differences between *Sphaerobolus iowensis* Walker and *Nidulariopsis melanocarpa* Greis are merely specific rather than generic and that the two should be included in the same genus *Nidulariopsis*. In this arrangement then *S. iowensis* becomes **Nidulariopsis iowensis** (Walker) n. comb.

Since the two genera are so specialized in peridial structure and discharge of the gleba they are retained in the same family, *Sphaerobolaceae*.

Fischer (**1933**) referred this family to the Sclerodermatales as a special family. Its closest relationship in this order is to the *Calostomataceae*, because of the similarity in discharge of gleba. However, in *Calostoma* the spore sac is inverted and ejected through the stoma after the gleba has become a powdery mass, mostly spores. It would seem more reasonable to follow the usual procedure and include the *Sphaerobolaceae* with the *Nidulariaceae* in the Nidulariales.

PODAXALES

1. **Secotium albipes** sp. nov.

Fructificationes turbinatae, stipitatae; pileo circa 4 cm. alto, 5 cm. crasso, subgloboso, inferne a stipite inseparabili; superficie laevi, glabra, viscida, rubra, siccitate obscuriore; stipite 1–1.5 cm. longo, sursum crasso inferne tenuiori, solido vel farcto, superficie siccitate alba, interne obscuriore, superne in columellam crassam percurrentem procurrente, peridio circa 650 μ crasso (sicc.), prosenchymate gelatinoso composito, siccitate duro obscuroque; gleba obscure brunnea, locellis parvis; basidiis 1-, 2-, et 4-sporigeris; sporis brunneis, ellipsoideis, laevibus vel subrugulosis, guttulatis, 6–8 × 12–18 μ; cystidiis magnis conicis hyalinis.

[11] Lohwag H. Die Homologien im Fruchtkörperbau der höheren Pilze. I und II. Biologia generalis **2**: 148–182, 575–608. 1926.

Fructifications turbinate, stipitate, up to 4 cm. tall and 5 cm. wide; pileus subglobose; smooth, glabrous, viscid, red, drying dark mineral red, not breaking from the stipe below; stipe short, 1–1.5 cm. long, broad above and tapered sharply downward, solid, drying dark within but whitish on the surface; columella percurrent, broad, but broader above and below; peridium about 650 μ thick (dry), of gelified, prosenchymatous tissue, drying dark and hard; gleba dark brown, locules small; basidia 1-, 2-, and 4-spored; spores brownish, narrowly ellipsoid, smooth but with occasional raised spots, guttulate, 6–8 × 12–18 μ; cystidia large, conic, hyaline.

On the ground in rich forest duff.

California: Butte county, Merrimac, *Thelma Norman,* Nov. 9, 1932, **type** (in N.Y.B.G. Herb.).

The above collection had been labeled "*Secotium erythrocephalum* Tulasne." This drew our attention again to the original description of the latter in which Tulasne describes the stipe as 'white.' Cunningham has described the stem as 'bright yellow' and several collections from New Zealand in American herbaria show yellow slender stipes.

Secotium albipes differs from *S. erythrocephalum* in other respects, however, than in stipe color. The edge of the peridium (pileus) does not readily separate from the stipe below as in *S. erythrocephalum,* which not only separates but often the edge is turned back (*repandus* Tulasne), thin, and coriaceous. The latter is doubtless a part of the fundamental veil separating from the stipe. The dried plants of *S. albipes* are short and stout whereas those of *S. erythrocephalum* are slender and tall. The spores of the latter are smooth and those of *S. albipes* are smooth but have a tendency to slight roughness and are definitely guttulate. *S. albipes* is similar to *S. tenuipes* Setchell in color of the peridium but the latter has a brown stipe and the spores are dark brown, rough and citriform as in those of *Hymenogaster.*

2. SECOTIUM NUBIGENUM Harkness.

A recent note [12] indicated the loss of the type of this species, but in the N.Y.B.G. there is a collection with the label in Harkness' handwriting as follows: "*Secotium nubigenum* Hks., on logs of *Pinus contorta,* Summit of the Sierra Nevada." An additional

[12] Zeller, S. M., Mycologia **33**: 210. 1941.

note that accompanied the original description is "7000 ft." Since this specimen was collected by Harkness at the type locality I have taken the liberty to label it "**type**." Unless Harkness distributed type material elsewhere, this at least is the only collection *so authentic*.

3. SECOTIUM SESSILE Massee and Rodway, in Rodway, Roy. Soc. Tasmania, Proc. **1911**: 31. 1912. (*Elasmomyces sessile* Rodw. Roy. Soc. Tasmania, Proc. **1924**: 8. 1925.)

A part of the type of the above is in the N.Y.B.G. Herbarium. The packet containing the collection is inscribed with the following in George Massee's handwriting: "*Secotium sessile* Mass. & Rodw., Tasmania, Rodway 649. *type*." The specimens are in every particular the same as *Elasmomyces Mattirolanus* Cavara, with which it becomes synonymous.

TWO NEW ORDERS

The genera of the Gasteromycetes for the most part fall into the older, established, and quite generally accepted orders, as follows:

1. THE HYMENOGASTRALES, which include mostly hypogeous species that retain the original glebal structures to maturity. Such genera have been assigned to the families *Protogasteraceae, Gasterellaceae, Melanogasteraceae, Rhizopogonaceae, Hymenogasteraceae,* and *Hydnangiaceae*. They contain about twenty-two genera.

2. THE HYSTERANGIALES include hypogeous or epigeous species with gelatinous or cartilaginous tissues and smooth, ellipsoid spores (phalloid) but without a so-called receptacle. They have been assigned to the families *Hysterangiaceae, Protophallaceae,* and *Gelopellaceae*. The three families contain seven genera.

3. THE PHALLALES are divided into the three families—*Claustulaceae, Phallaceae,* and *Clathraceae*. The species here have bacillar spores, the peridium a volva with at least one gelatinous layer (and that layer interrupted by sutures of fundamental tissue in the *Clathraceae*), and the gleba variously dispersed or elevated on a pseudoparenchymatous stem, or a clathrate or hollow structure known as the receptacle. There are about twenty genera referred to this order.

4. THE LYCOPERDALES, which include the "puff ball" types of fructifications having ordinary hyphal tissues that are not gelatinous or cartilaginous, the gleba disintegrating into a powder or into small hollow peridioles at maturity, and with a capillitium (except in *Arachniaceae*). The species here are assigned to the families *Arachniaceae, Broomeiaceae, Mycenastraceae, Lycoperdaceae, Mesophelliaceae,* and *Geastraceae.* These include about twenty-five genera.

5. THE SCLERODERMATALES that include species with heavy peridial and other tissues, and gleba pulverulent at maturity; basidia symmetrically distributed or in nests or cavities arising through the dissolution of the tissue, at least without a well organized hymenium (except possibly in *Batarrea*). The order has been divided into the families *Sclerodermataceae, Pisolithaceae, Glischrodermataceae, Sedeculaceae, Astraeaceae, Tulostomataceae,* and *Calostomataceae.* These families include seventeen genera.

6. THE NIDULARIALES, which are the distinctive "Bird's Nest" fungi and need no description here but are divided into the two families *Nidulariaceae* and *Sphaerobolaceae,* including six genera.

7. THE PODAXALES, the species of which have a percurrent columella or stem reaching to the summit of the fructification; peridium left at maturity in part as a pileus or volva, or annulus on the stem; gleba at first with hymenium of basidia covering the walls of chambers or pores or lamellae, persistent or pulverulent; spores colored. The order has two families, the *Secotiaceae* and the *Podaxaceae,* containing seven genera.

This treatment of the Gasteromycetes leaves four genera to be considered. These are *Clathrogaster, Gasterosporium, Gautieria,* and *Tremellogaster. Tremellogaster* and *Clathrogaster* may readily be placed in the same family because of their peridial and glebal characters. The peridia of these two genera are composed of at least two layers. The outer layer is of filamentous, fundamental tissue, forming a thin rind. Under this there is a thick gelatinous layer. In this layer the hyphae are far apart but are dispersed through a thick gel. This gelatinous layer is interrupted here and there by more or less radial plates (sutures) of more compactly interwoven hyphae, the same as the outer layer, and connecting the latter with the gleba, much as in the family *Protophallaceae*

and in the early button stages of the *Clathraceae*. In the peridium of *Tremellogaster* these sutures are more numerous and complicated than in *Clathrogaster*.

The peridium of *Gastrosporium* as previously reported [13] is very similar to that of the *Gelopellaceae* and to the volva in the button stages of the *Phallaceae*. The glebae of *Gastrosporium* and *Tremellogaster* are pulverulent at maturity. Whether the gleba of *Clathrogaster* retains its original structure to maturity is not known, but in other respects it is similar enough to *Tremellogaster* to be included in the same family with it. The type material of *Clathrogaster* was originally, at least, kept in preservative and the development of the gleba was arrested as at the time of collection. All of these genera, however, have spherical, echinulate or sculptured spores and, therefore, do not belong in the series of genera with phalloid spores, such as those of the Hysterangiales and Phallales.

To judge only from the gelatinous or cartilaginous character of the tissues in *Gautieria* this genus should take its place somewhere in the *Melanogastraceae, Hysterangiaceae,* or possibly the Sclerodermatales. Glebal characters, however, make it incompatible with the *Melanogastraceae* and the Sclerodermatales and the spore characters would keep it out of the *Hysterangiaceae*. One might stretch a point and place the genus *Gautieria* with the *Hymenogastraceae* having like spores, but it does not otherwise belong.

Two new orders are consequently proposed to receive these genera. The first, the **Tremellogastrales,** contains two families; the **Tremellogasteraceae** n. fam., including the genera *Clathrogaster* Petri and *Tremellogaster* Ed. Fischer, and the *Gastrosporiaceae* Pilat, including the one genus *Gastrosporium* Mattirolo. The second new order, the **Gautieriales,** contains the **Gautieriaceae** n. fam. with the one genus *Gautieria* Vittadini.

TREMELLOGASTRALES n. ordo

Fructificationes hypogeae vel epigeae, sessiles; peridio duplici, strato externo hyphis intricatis composito, strato interno gelatinoso continuo vel laminis radiantibus interrupto investitoque; gleba primo carnosa, dein pul-

[13] Zeller, S. M. New and noteworthy Gasteromycetes. Mycologia **31**: 1–32. 1939 (see p. 17).

verulenta; columella simplici vel dendroidea, vel deficienti; sporis sphaericis, echinulatis vel verrucosis.

Fructifications hypogeous or epigeous, mostly sessile; peridium of two or more layers, the outer of fundamental tissue, the inner of a gelatinous nature, continuous or interrupted by sutures of fundamental tissue; gleba centripetally developed, pulverulent at maturity; columella simple or wanting; spores spherical, echinulate or verrucose.

KEY TO THE FAMILIES OF THE ORDER TREMELLOGASTRALES

I. Peridium with a gelatinous inner layer interrupted by sutures of fundamental tissue; spores spherical, echinulate or rough..*Tremellogasteraceae*
II. Peridium with a simple gelatinous inner layer, not interrupted by sutures; spores spherical, minutely verrucose.....*Gastrosporiaceae*

A. **Tremellogasteraceae** n. fam.

Fructificationes hypogeae vel epigeae, sessiles; peridio duplici, strato externo hyphis intricatis composito, strato interno gelatinoso laminis radiantibus interrupto investitoque; gleba ochracea vel flavida, primo carnosa, dein pulverulenti; columella dendroidea vel deficienti; basidiosporis sphaericis, echinulatis vel cristatis.

Fructifications epigeous or hypogeous, subglobose, sessile; peridium of two or more layers; exoperidium of fundamental tissues; endoperidium of one or more layers of gelatinous tissue interrupted by plates of fundamental tissue; gleba developing centripetally from hyphae from the margins of the medulla of the primordium, pulverulent at maturity; capillitium rudimentary; columella sometimes present; spores spherical, echinulate or cristate.

KEY TO THE GENERA OF THE TREMELLOGASTERACEAE

I. Tramal peridium very thick, with branched sutures of fundamental, filamentous tissue dividing the gelatinous portion of the inner peridium radially and into two more or less definite layers; spores spherical, echinulate .....*Tremellogaster*
II. Tramal peridium thinner, of one gelatinous layer interrupted by more or less simple, radial sutures; spores spherical, echinulate and ridged, or ridged only.....*Clathrogaster*

1. TREMELLOGASTER Ed. Fischer, in Mitteil. Naturf. Ges. Bern **1923**: 49–56. 1924.

Emended description: Fructifications epigeous, subglobose; surface drying coarsely flattened-tuberculate; peridium very thick, up

to ⅙ the diameter of the sporocarp, with an outer layer of thick-walled, sclerotioid hyphae bordered internally by thin-walled, hyaline periclinal hyphae, a middle layer is brownish, gelatinous, reticulately divided by lighter colored nongelatinous, fundamental tissue (partitions or sutures), and a white inner layer is nongelatinous, of hyphae that intertwine and run parallel with the surface of the gleba; the latter ochre to brown, becoming pulverulent at maturity; pseudocapillitium various lengths, 2.5–4 μ in diameter, much branched, hyaline, sparsely warty-spinulose; basidia forming a palisade-like hymenium on the walls of lacunae through which many hyphae penetrate, 4-spored; sterigmata short; spores spherical, echinulate, dark brown, 5–6 μ in diameter.

Type species: *Tremellogaster surinamensis* Ed. Fischer.

Habitat: On moist sandy soil, near decaying wood.

Distribution: British and Dutch Guiana, South America.

There is but the one species in the genus, and the above description serves very well for the species.

2. CLATHROGASTER Petri, Malpighia **14**: 125–126. 1900. Description emended.

Fructifications hypogeous, subglobose, radicate, rhizomorph attached in a depression in the base; peridium thick, of 2 layers, outer of fundamental, periclinal hyphae, thin, silky, reticulately furrowed; inner layer thick, gelatinous, interrupted by more or less radial sutures of tissue like the outer peridium and connecting the latter with the gleba; lactiferous ducts large, long, penetrating all sterile tissues; gleba chambered, spongy, yellowish, cavities spherical to irregular, larger toward the outside, with one to many very large radiating, gelatinous, sterile cavities; septa broad, with stipitate basidia and cystidia on both sides; columella or prominent tramal plates radiating from the base or from a pulvinate sterile base; basidia mostly 2-spored; spores spherical, yellowish, reticulate with interrupted ridges, pedicellate.

The type species: *Clathrogaster volvarius* Petri.

Distribution: Sarawak, near Sibu, Borneo.

a. Clathrogaster volvarius Petri, Malpighia **14**: 126. *pl. 2, f. 1–2; pl. 3, f. 2, 3, 5–8, 10, 13; pl. 4, f. 1.* 1900. (*Arcangeliella volvaria* (Petri) Z. & D. Mo. Bot. Gard. Ann. **22**: 369. 1935; **23**: 629. 1936.)

Fructifications irregular reniform about 4 × 6 cm., russet (in alcohol, 1934), surface irregularly reticulate-sulcate; sterile base scarcely more than a thickening of the peridium; columella conspicuous, branching near the base but branches percurrent or nearly so, gelatinous with many lactiferous ducts; peridium 1200–1440 μ thick (in alcohol), duplex, the outer layer (rind) of densely tangled hyphae, tough, somewhat gelatinous, the inner a thick gelatinous layer (tramal peridium), with many large lactiferous ducts, interrupted by radial plates (sutures) of tissue like the rind which connects the outer peridium and the *gleba;* the latter ochraceous-tawny, cavities ovoid, radiating from the columella and base; septa thick, of loose, gelatinous hyphae, with lactiferous ducts; basidia subcylindrical, 37–40 μ long, upper part collapsing after the separation of the spores; sterigmata short; spores spherical with short ridges and slender, blunt spines, yellowish, 9–12 μ in diameter.

Type locality: Sarawak, Borneo.

Distribution: Known from type locality only.

In his formal description of the species *C. volvarius,* Petri used the old spelling *"vulvarius,"* but in all other cases throughout his paper he used *"volvarius."* Undoubtedly the use of the "u" in the one case was unintentional and thus our correction.

Petri did not designate a type species of *Clathrogaster. C. volvarius* Petri was chosen as the type since it was the better described and illustrated of the two species.

b. Clathrogaster Beccarii Petri, Malpighia **14**: 126. *pl. 2, f. 3–5, 7–9.* 1900. (ut *C. Beccari.*) (*Arcangeliella Beccarii* [Petri] Z. & D. Mo. Bot. Gard. Ann. **22**: 366. 1935; **23**: 635–636. 1936.)

Fructifications spherical to reniform, 1–3 cm. in diameter, raw sienna in alcohol, surface smooth but with low reticulated ridges; sterile base and columella not perceptible; peridium about 600–700 μ thick (in alcohol), duplex, the outer layer of compactly interwoven hyphae producing a rind, the inner layer thick, gelatinous of loosely woven hyphae mixed with lactiferous ducts, interrupted by radial plates (sutures) of fundamental tissue like the rind, and uniting the latter with the gleba; the latter amber-brown, cavities elongate, radiating from the base which is scarcely more than a thickened peridium; septa about 110 μ thick, similar to the inner peridium in structure; basidia clavate, 2-spored, about 80 ×

11 μ, only the outer half collapsing after the separation of the spores; sterigmata short; spores 11–15 μ in diameter, spherical, with very high ridges, irregularly disposed over the surface, yellow.

Type locality: Sarawak, Borneo.

Distribution: Known from the type locality only.

B. GASTROSPORIACEAE Pilát, Bull. Soc. Myc. France **50**: 45–46. 1934.

Description emended: Fructifications globose, hypogeous; peridium duplex; exoperidium of filamentous, fundamental tissues; endoperidium a continuous gelatinous layer, *not* interrupted by plates of fundamental tissue; gleba developing centripetally from anastomosing lamellae, produced subperidially, pulverulent at maturity; columella present; capillitium rudimentary; hymenium lining walls of cavities; spores spherical, minutely verrucose.

There is one genus, *Gastrosporium*.

1. GASTROSPORIUM Mattirolo, Memoria Accad. Sci. Torino, Ser. II **53**: 361. 1903. (*Leucorhizon* Velenovsky in Mykologie **2** (3–4): 49–51. *f. 1–4.* 1925.)

Description emended: Fructifications hypogeous, globose; surface soft, white, dry; peridium duplex; outer layer filamentous, easily separable; inner layer tough, gelatinous, cartilaginous, indehiscent, continuous, easily distinguished from the gleba; the latter filling the whole peridium (no sterile base), white, becoming ochraceous to subolivaceous, with main tramal plates extending from a columella which is simple but reaching beyond the center of the fructification; hymenium lining cavities at first, but the whole pulverulent at maturity; capillitium rudimentary; spores light ochraceous, spherical, slightly verrucose.

Type species: *Gastrosporium simplex* Mattirolo.

Habitat: In the soil around the roots of grasses and sedges.

Distribution: Northern Italy and Czechoslovakia.

There is but one species in the genus *Gastrosporium*. Velenovsky, however, described a species *Leucorhizon nidificum* which becomes synonymous with *G. simplex*. It is peculiar that Velenovsky, Pilát [14] and Mattirolo overlooked the fine verrucosity of

[14] Pilát, A. Sur le genre Gastrosporium Mattirolo. Bull. Soc. Myc. France **50**: 37–49. *illus.* 1934.

the spores. A collection under the name *Leucorhizon nidificum* Vel. from Bohemia is to be found in the Lloyd collections (Smithsonian Inst. Cat. No. 148).

GAUTIERIALES n. ordo

Fructificationes hypogeae, sessiles, basi rhizomorphico instructae; peridio deficienti vel hyphis laxe intricatis vel pseudoparenchymatibus composito; gleba primo albida translucento-cartilaginea, dein brunneola cartilaginea; columella simplici vel dendroidea, cartilaginea; septis hyphis gelificatis compositis, hymenophori; basidiosporis crasse fusiformibus, longitudinaliter costatis, brunneis.

Fructifications hypogeous, sessile; peridium usually wanting, when present stupose, loosely filamentous, or pseudoparenchymatous; gleba gristly-translucent, whitish, becoming brownish as spores mature, with a columella from a basal rhizomorph; basidia in a hymenium; septa usually gelatinous-cartilaginous, of gelified hyphae; basidiospores of various shapes, mostly broad fusiform, longitudinally costate, brown.

Gautieriaceae n. fam. Characteribus ordinis.

The order Gautieriales, represented by the one genus *Gautieria,* partakes of the characters of several other groups of gasteromycetes but differs fundamentally from each enough that it cannot logically be classified with any. The fructifications follow the centrifugal, coralloid pattern of development and the gleba has a conspicuously gelatinous-cartilaginous consistency such as found in the Hysterangiales, but the gleba and spores do not partake of the phalloid nature of those of the latter. Nor does the peridium when present in species of *Gautieria* have the gelatinous or cartilaginous layers found in the same parts of the Hysterangiales. The spore type in the Gautieriales is similar to that found in *Hymenogaster, Gymnoglossum,* and *Secotium,* but the development of the fructifications is distinct as is the nature of the sterile tissues. The order Gautieriales differs from the Tremellogastrales in four fundamental respects. In the latter the gleba develops centripetally (lacunar), the peridium is characterized by gelatinous layers, the spores are spherical, and echinulate or verrucose, and the gleba becomes powdery at maturity.

To obtain the best concept of the genus *Gautieria* it is necessary to know several of its species as they occur in the field, so to

speak. Otherwise one does not become aware of the tough, gristly nature of the sterile tissues in most of the species. For instance, the type species *G. morchelliformis* Vitt. has such large glebal cavities and thin tramal septa that, although it has the same characters otherwise as the other species, the observer is not so impressed with its gelatinous-cartilaginous nature, as when he sees some other species of the genus with thicker septa, columella, etc. In fact the examination of dried specimens of *G. morchelliformis* may not reveal the real cartilaginous character of its tissues. In other words the type species of *Gautieria* does not represent the *norm* of the genus, but may be said to be almost marginal.

1. GAUTIERIA Vittadini, Monogr. Tuberac. 25–27. 1831.—*not Gautiera* Rafinesque Med. Fl. **1**: 202. 1828. (Syn. *Chamonixia* Rolland, Soc. Myc. France Bul. **15**: 76–77. 1899.)

Description emended: Fructifications subspherical to irregularly depressed, with a simple or branched rhizomorph sometimes persisting as a short stipe; columella variable, simple or branched, gelatinous to translucent-cartilaginous; peridium wanting, evanescent, or persistent, when early evanescent or wanting outer septa sterile over the surface; gleba white or gristly-translucent, becoming brownish as spores mature; cavities labyrinthiform; septa usually thick, gelatinous-cartilaginous, of interwoven, gelatinized hyphae; basidia in hymenium covering both sides of septa; spores ovoid, ellipsoid, fusiform, with longitudinal striae, brown.

Type species: *Gautieria morchelliformis* Vitt.

Habitat: Wholly or partially hypogeous under various kinds of shrubs and trees.

Distribution: Europe, Asia, Africa, North and South America, Australia, Tasmania, New Zealand.

The species of *Gautieria* have been published elsewhere.[15]

Eleven species have been reported from North America and eight others occur elsewhere in the world.

A NEW FORM ORDER OF FUNGI IMPERFECTI

Lycoperdellon Torrend (in Broteria Sér. Bot. **11**: 92. 1913) has had a very doubtful taxonomic position. Fischer (1933, p.

[15] Dodge, C. W., and S. M. Zeller, Mo. Bot. Gard. Ann. **21**: 692–705. *pl. 18, f. 51–66.* 1934.

72) referred it to the doubtful list of genera under the *Lycoperdaceae*. To be sure, the fructifications of *Lycoperdellon* have the general appearance of a myxomycete, like *Lycogala,* or a lycoperdaceous gasteromycete but there are no basidia or basidiospores. Lohwag [16] accordingly recognized the sporophores as real conidiophores and thought them to represent the conidial stage of an ascomycete. The conidial stages of ascomycetes so far as we know, however, do not take on the form of a closed sporocarp similar to a gasteromycete. There is no doubt *Lycoperdellon* is one of the Fungi Imperfecti, but its closest relatives are doubtless among such forms as *Leucophleps* Harkness, all the species of which, except *L. candida* Harkness, have proved to be the conidial stage of one or another of the species of the gasteromycetous genus, *Leucogaster* Hesse. After considerable careful study of *Lycoperdellon* by Heim and Malençon [17] who continued to designate its spores as "conidia," Heim described the family *Lycoperdellaceae* to receive the genus *Lycoperdellon* with its two species *L. Torrendii* (Bresad.) Torrend and *L. minutum* Heim.[18] Unfortunately he assigned the family to the Gasteromycetes whereas from our viewpoint it belongs in the Imperfecti. It is, therefore, proposed to transfer the family *Lycoperdellaceae* Heim to the Fungi Imperfecti and refer to it the form genera *Lycoperdellon* Torrend and *Leucophleps* Harkness. There will need also to be the Form Order **Lycoperdellales** [19] coordinate with the Phyllostictales, Melanconiales, and Moniliales. In a key like Martin's [20] the new form order would key out as follows: "Fructification determinate, gasteromycetoid; conidia borne in chambered cavities or nests."

Leucophleps candida Harkness has been found in western Oregon and central California. Neither species of *Lycoperdellon* has been reported from North America.

[16] Lohwag, H. Zu Lycoperdellon. Ann. Myc. **32**: 244–255. 1934.

[17] Heim, Roger, and G. Malençon. Le genre Lycoperdellon: structure et position taxonomique. Rev. Gen. de Bot. **45**: 53–67. 1933.

[18] Heim, R. Fungi Ibirici. Treballs del Mus. Cien. Nat. Barcelona **15** (No. 3): 1–146. 1934. (See pp. 138–141.)

[19] Fructificationes gasteromycetoides, sed conidia gignentes.

[20] Martin, G. W. Key to the families of fungi. Univ. Iowa Stud. in Nat. Hist. **17**: 83–115. 1936. (See p. 90.)

STUDIES IN THE DARK-SPORED AGARICS *

ALEXANDER H. SMITH

(WITH 93 FIGURES)

The present study deals chiefly with notes on the microscopic characters of the types of some of the species of *Coprinus, Naematoloma, Panaeolus* and *Psilocybe* described from North America. As has long been recognized by investigators who are working in this group, the descriptive accounts, whether old or new, which do not place great emphasis on spore morphology, on the characters of the cystidia if such are present, and on the anatomical features of the fruiting bodies, are of little value in accurately delimiting taxonomic entities of any category. It naturally follows, then, that one of the first steps in a critical revision of these genera is to ascertain the diagnostic characters from the type specimens in so far as the latter are available. However, as I found out early in my work in this group, an extensive knowledge of these fungi as they occur in nature is an invaluable aid in interpreting the characters of dried specimens. Consequently, although my investigations in the group have been in progress for over ten years, it is only comparatively recently that I have established species concepts in many of the genera that are satisfactory to me, and which serve satisfactorily as the building units for a classification which is other than just haphazard.

Considerable progress has been made in the recognition of species in the field through the process of mass collections, *i.e.*, collecting material of *all* fruitings of dark-spored agarics found during a season. Through such methods one soon learns to recognize the frequently-encountered species and to ascertain the constancy of their characters even though he may be unable to apply binomials correctly to them. The studies of type specimens do much

* Papers from the Herbarium and the Department of Botany of the University of Michigan. The cost of the illustrations was paid for by the University of Michigan Herbarium.

to clear up the application of names, and the final result should be a satisfactory classification in which the species are adequately described. This, at least, is the aim in the manuscript being prepared for the *North American Flora*.

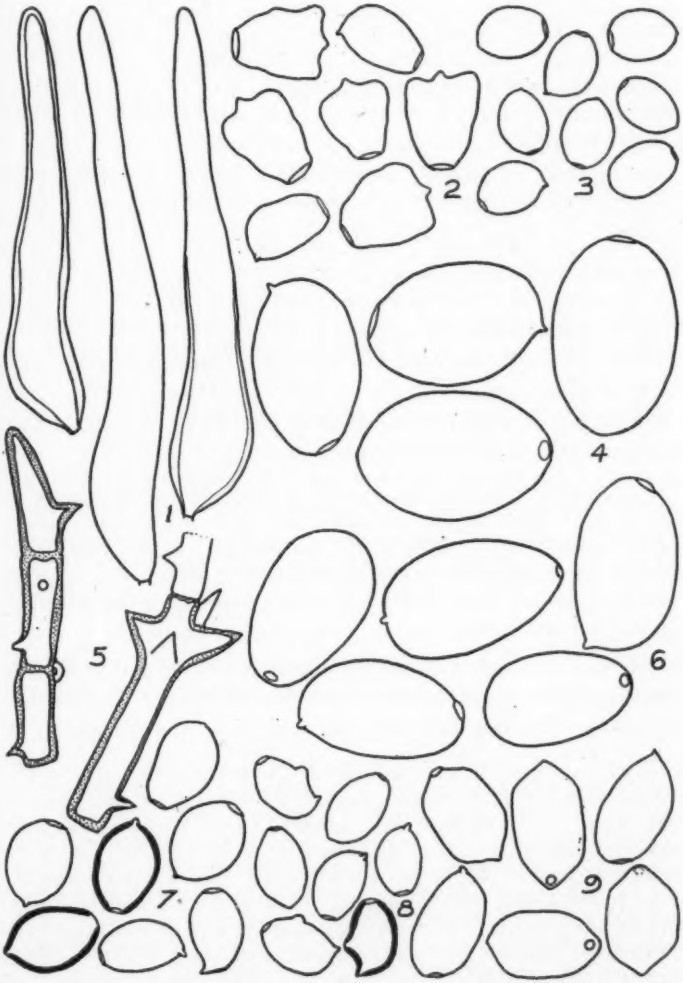
Because of the interest being shown in dark spored agarics both by European and American workers at the present time, and because of the general impetus given to the study of fleshy fungi by those seeking new antibiotics for medicinal use, it is urgent to make available such data as that presented here. Since the characters of the spores are fundamental, and since they have been badly handled by past investigators, detailed descriptions as well as illustrations are included. Although the genera treated here are classed as "dark-spored" fungi, it must be remembered that in *Stropharia, Naematoloma* and *Psilocybe* this character breaks down, and species with earth-brown to cinnamon-brown spore deposits must be admitted if any emphasis at all is placed on obvious natural relationships. The more material I examine, the more I become convinced that actually the genus *Agrocybe* of modern authors should be placed here also.

For access to type specimens reported on here I am indebted to Dr. H. D. House, State Botanist, New York State Museum, Albany, New York, to Dr. Fred J. Seaver, of the New York Botanical Garden and to Dr. Rolf Singer, Farlow Herbarium, Harvard University, Cambridge, Mass.

COPRINUS

COPRINUS ANGULATUS Peck, Ann. Rep. N. Y. State Mus. **26**: 60. 1874. (FIGS. 1–2–*type*.) Spores 8.5–10 (11) × 5.7–6.3 × 7–8.8 μ, dark bister to blackish revived in KOH, somewhat flattened, truncate-ellipsoid in side view, resembling a blunt arrow head in face view, apical hyaline pore broad and conspicuous; basidia 18–32 × 7–9 μ, four-spored, trimorphic; paraphyses inflated, hyaline, readily collapsing; pleurocystidia voluminous, ellipsoid to cylindric (50) 60–100 (120) × (15) 20–60 μ, hyaline, smooth, thin-walled and readily collapsing; cheilocystidia vesiculose and 15–40 μ in diam., or fusoid-ventricose [the latter 38–46 (55) × (7) 9–14 μ], both types thin-walled and hyaline; gill trama hyaline in KOH or colored cinnamon-brown toward pileus trama; pileus trama with a cuticle of vesiculose cells one cell deep, from

among them arise numerous pilocystidia (32) 60–90 × 9–16 μ, subcylindric to ventricose at base, apices obtuse to subacute, the walls thin and hyaline or slightly thickened in basal part and either hyaline or tawny as revived in KOH; flesh beneath cuticle tawny to cinnamon-brown in KOH.



FIGS. 1–9. Microscopic characters of dark-spored agarics.

Discussion. Peck's original description and comments indicate that this species belongs in the *C. ephemerus* group, and the present study of the type makes this disposition unquestionable. The pilocystidia are abundant and unmistakable.

COPRINUS CALYPTRATUS Peck, Bull. Torr. Club **22**: 205. 1895. (FIG. 4–*type*.) Spores 17–21 × 10–13 μ, not appreciably flattened, hyaline pore small and slightly eccentric in side view of spore, walls only moderately thick and in KOH dark bister (no other details obtainable from type, and spores examined were slightly immature.

Discussion. I consider *Coprinus asterophorus* Long and Mentzer, Mycologia **37**: 120. 1945 to be a synonym of this species. Its spores (FIG. 6) are not quite as broad in the one collection illustrated, but Long and Mentzer described them as 14–20 × 10–12.7 μ, and in material sent me by the late Dr. Long considerable variation was evident. The patch of the volva which forms a yellowish cap on the pileus is apparently the important diagnostic field character. In its spore characters the fungus is very similar to *Coprinus sterquilinus* but differs sharply in the more compact organization of the veil tissue.

COPRINUS BRASSICAE Peck, Ann. Rep. N. Y. State Mus. **43**: 18. 1890. (FIG. 3–*type*.) Spores 6.2–7.8 × 3.6–4 μ, dull cocoa brown when first revived in KOH, not flattened, ellipsoid in either view, hyaline apical pore distinct but small; basidia four-spored, hyaline in KOH; (no other microscopic characters determinable on material examined).

Discussion. Unfortunately the characters of the veil could not be determined. These are important in this group. The species has received considerable attention in the American literature.

COPRINUS CINCHONENSIS Murrill, Mycologia **10**: 85. 1918. (FIGS. 5 & 7–*type*.) Spores 9–11 × 5–6 × 6–7.5 μ, subelliptic in side view, ovoid in face view, terete or only slightly flattened, smooth, pale bister in KOH, apical pore hyaline and distinct; basidia hyaline in KOH, four-spored, 7–8 μ broad at apex; paraphyses hyaline, thin-walled, inflated, 10–14 μ diam.; pleurocystidia apparently present but remaining collapsed and details not clear, hyaline and thin-walled; cheilocystidia none seen; gill and pileus trama hyaline in KOH; universal veil remnants in the form of matted fibrils in patches over the disc (no globose cells seen),

the hyphae much-branched, with somewhat thickened walls and with scattered short thorn-like processes unevenly distributed over them, the cells nearly hyaline to slightly yellowish in KOH.

Discussion. This is a distinctive species if one considers the characters of the veil and spores in conjunction with the habitat on a log. It appears to be closely related to *Coprinus Brassicae* Peck but is readily distinguished on spore size.

COPRINUS EBULBOSUS Peck, Bull. Torrey Club **22**: 491. 1895. (FIG. 8–*type.*) Spores 7–8.4 × 4.4–5 μ, dull chocolate-brown revived in KOH, smooth but often with a ventral hump as seen in side view (apparently a second pore), oblong to subellipsoid in face view, subellipsoid to slightly inequilateral in side view, apical pore present but obscure; basidia four-spored, hyaline in KOH, 18–24 × 7–8 μ, apparently trimorphic; paraphyses 10–16 × 10–16 μ, subglobose, hyaline in KOH; pleurocystidia scattered; subcylindric, 80–120 × 18–32 μ, thin-walled and readily collapsing; cheilocystidia none seen; gill trama of filamentous hyphae, hyaline in KOH; pileus trama hyaline in KOH, cuticle of vesiculose hyaline cells about 1 cell deep.

Discussion. Both the collection from Lyndonville, N. Y. and the one from Kansas show the curious ventral hump on at least some spores so there is no doubt but that both represent the same species. It is very closely related to *C. quadrifidus* Pk., but apparently differs in slightly narrower spores. However, this difference is not truly significant. From the information at hand it is not clear whether the ventral hump or second pore is an abnormality which occasionally occurs in the members of the *quadrifidus* group and is comparable to the bifid spores as reported by Lange (p. 743) for *C. myceliocephalus,* or whether it is a useful character.

COPRINUS HEXAGONOSPORUS Josserand, Bull. Soc. Myc. Fr. in press. (FIG. 9.) Pileus cylindric at first, 5–10 (15) mm. high, 4–6 (8) mm. across the base, very finely pubescent at least over the disc, disc "fuscous," marginal area pallid to "avellaneous," tinged "army brown" near the disc at maturity, surface closely folded-striate before expanding, becoming broadly convex to plane and plicate-striate before maturity; flesh very delicate and thin, odor none, taste mild to slightly bitterish; lamellae free but attached to apex of stipe, close, whitish, soon avellaneous and then black, narrow and equal (1–2 mm. broad), soon deliquescing; stipe 3–5 (10) cm. long, 0.5–1 (2.5) mm. thick, equal, hollow,

very fragile, sparingly pubescent at first from projecting caulocystidia, densely pubescent above, white at first but soon sordid brownish over lower two thirds, base inserted on the substratum.

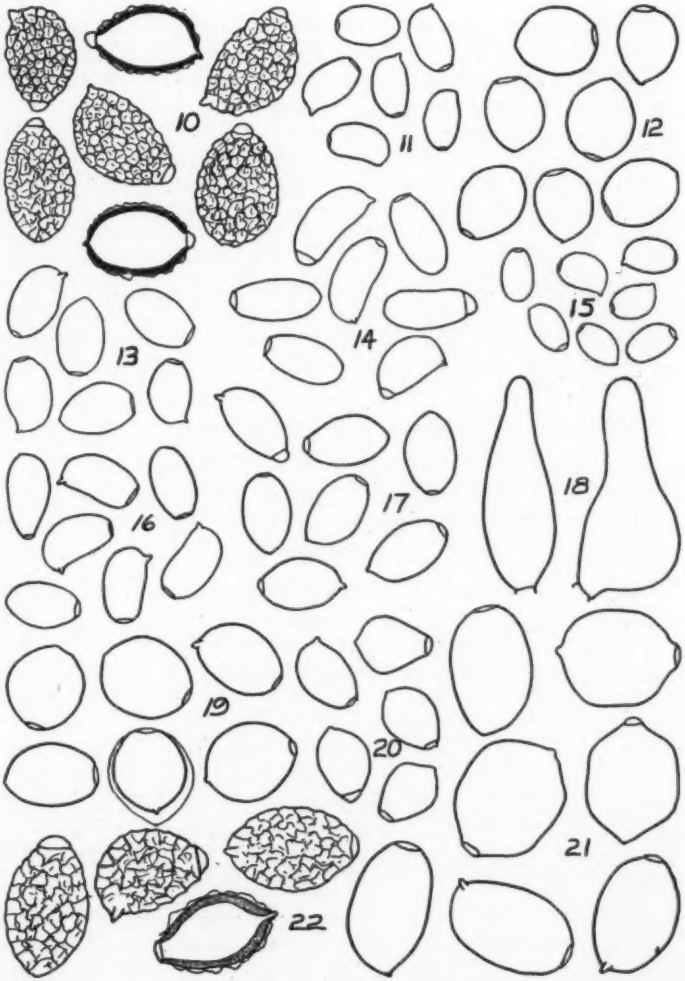
Spores black in deposit, 11–13 × 5–6.2 × 6.5–8 μ, black in KOH, flattened, subelliptic in side view, angular and obscurely six sided in face view, pore eccentric as seen in side view; basidia trimorphic, 18–26 × 8–10 μ; paraphyses 18–22 × 9–16 μ; pleurocystidia rare, 60–90 × 20–35 μ, becoming more elongated and narrower, readily collapsing; cheilocystidia similar to pleurocystidia or more vesiculose, 40–80 × 35–45 μ; gill trama narrow and of very loosely interwoven cells; pileus trama with a cuticle formed by a row of vesiculose cells from which thin-walled pilocystidia project, the latter 70–120 × 10–15 μ, trama proper very thin but hyphae filamentous, those in the dark discal area dark sordid brown (almost vinaceous brown) when revived in KOH.

Discussion. This fungus, a close relative of *C. ephemerus,* is apparently quite common on horse dung in the United States. I have isolated it on numerous occasions. Brooks obtained it from horse dung collected in Kansas, and both Brooks and Lange isolated it from the same substratum collected near Ann Arbor. The spores in face view are the outstanding feature of the species, but once the fungus is known it can usually be identified at sight. It has not been previously reported from North America.

COPRINUS INSIGNIS Peck, Ann. Rept. N. Y. State Mus. **26**: 60. 1874. (FIG. 10–*type.*) Spores 10–12.6 × 7–8.4 μ, dark bister in KOH, the exospore wrinkled and cracked to form obscure warts or causing surface to appear decidedly uneven, in side view slightly inequilateral, in face view oblong or base somewhat pointed, apex with a protruding lens-shaped hyaline pore causing it to appear snout-like; basidia four-spored, hyaline in KOH, paraphyses inflated, readily collapsing; pleurocystidia apparently subcylindric, elongated and projecting across the gill cavity (but remaining collapsed); cheilocystidia none seen; gill and pileus trama hyaline in KOH, the latter homogeneous or nearly so (with no sharply defined cuticle in sections of revived material).

Discussion. This well-known and characteristic species of the *C. atramentarius* group is known from both North America and Europe. The occurrence in several sections of *Coprinus* of rough spored and smooth-spored species with almost identical macroscopic characters is interesting in the light of recent efforts to

place great emphasis on spore markings in determining natural relationships among the fleshy fungi. The markings on the spores of *Coprinus* form excellent characters for the recognition of species, but if a natural arrangement is desired, it would be a serious



FIGS. 10–22. Microscopic characters of dark-spored agarics.

mistake to insist that all species with rough spores were more closely related to each other than to any with smooth spores. It is clearer in *Coprinus* than in almost any other genus that the character of ornamented spores has evolved independently on numerous occasions.

COPRINUS JALOPENSIS Murrill, Mycologia **10**: 83. 1918. (FIG. 11–*type*.) Spores 6–6.3 × 3.1–3.6 μ, cocoa-color as revived in KOH but gradually becoming grayish, smooth, not flattened, slightly bean-shaped in side view, subelliptic in face view, smooth, apical pore hyaline and inconspicuous; basidia hyaline in KOH, 12–18 × 5–5.5 μ, four-spored, trimorphic; paraphyses thin-walled, hyaline, readily collapsing, 9–12 × 6–9 (12) μ, enlarging to greatest size at time spores are discharged; pleurocystidia abundant and voluminous, hyaline, thin-walled and readily collapsing, extending across the gill cavity and 20–40 μ in diam.; cheilocystidia not reviving, the gill edges whitish apparently from filamentous hyphae; gill trama not reviving well but hyaline in KOH; pileus trama tawny yellowish to tawny-orange just under the cuticle, cuticle of a single layer of inflated cells, no pilocystidia or universal veil remnants found.

Discussion. This species must belong in the *C. radians* group, though its veil characters, if a veil is present, are not known. The oozonium and the small cocoa-colored spores along with the lignicolous habitat are certainly suggestive. The very small spores appear to characterize it in this group.

COPRINUS JONESII Peck, Bull. Torrey Club **22**: 205. 1895. (FIG. 12–*type*.) Spores 7–9 × 6–7 μ, terete to very slightly compressed, subellipsoid in side view, subcircular in face view, black or nearly so in KOH, exospore separable from endospore only under considerable pressure (enough to break inner spore wall in many instances), apical hyaline pore broad and distinct; basidia four-spored, hyaline in KOH, 7–8 μ in diam., trimorphic; paraphyses hyaline, thin-walled, readily collapsing, 10–12 μ broad; pleurocystidia projecting across gill cavity but not reviving well, apparently long-cylindric and thin-walled; cheilocystidia none seen; gill and pileus trama hyaline in KOH; universal veil remnants filamentous, hyaline to sordid brownish in KOH.

Discussion. A member of the *C. lagopus* series, but distinct on spore characters. *C. lagopus* var. *rotundisporus* Kuhner & Josserand is either identical with or very close to Peck's species.

COPRINUS LANIGER Peck, Bull. Torrey Club **22**: 491. 1895. (FIG. 14–*type*.) Spores dark sordid reddish brown when first revived in KOH but soon chocolate-grayish, 8–10.5 × 3.5–4.2 μ, smooth, not flattened, narrowly ellipsoid to subcylindric in face view, in side view almost straight to decidedly concave on inner side and the back distinctly to merely obscurely convex, lens-shaped pore apical and conspicuous when not collapsed; basidia four-spored, 14–24 × 5–6 μ, trimorphic, hyaline in KOH; paraphyses inflated, 12–15 × 8–12 μ, hyaline, readily collapsing; pleurocystidia scattered, ellipsoid to subcylindric, 50–90 (or more) × 16–30 μ, thin-walled and readily collapsing; cheilocystidia not seen (cells had deliquesced); gill trama hyaline to faintly yellowish in KOH; pileus trama merely yellowish in KOH, the cuticle of inflated cells one cell deep; universal veil remnants distinctive: the layer next to cap surface of chains of globose to keg-shaped hyaline cells, the cells of the chains more elongated outward as well as more brownish and the filaments finally composed of more or less ellipsoid to cylindric, tawny-cinnamon (in KOH), somewhat thick-walled cells which are smooth except for obscure zones and lines of encrusting pigment, the end cell often somewhat fusoid and cystidium-like, the chains of cells showing a tendency to break up into short segments or individual cells.

Discussion. This species is very closely related to *C. domesticus,* but differs from it in the long narrow spores with the very broad germ pore. The clustered habit of growth is a less constant distinguishing character. It is one of the extreme variants of the *domesticus–radians* series which at least for the present is being recognized as a species.

COPRINUS MEXICANUS Murrill, Mycologia **10**: 84. 1918. (FIG. 15–*type*.) Spores 4.7–5.3 (6) × 3.1–3.6 μ, pale cocoa-brown but soon changing to pale avellaneous when revived in KOH, many nearly hyaline, smooth, not flattened, ellipsoid to slightly inequilateral in side view, ellipsoid in face view, apical hyaline pore very small and inconspicuous; basidia and paraphyses not reviving; some fusoid-ventricose cystidia seen in crushed mounts of gills, these 28–36 × 9–12 μ and with obtuse to subacute apices; gill trama not reviving; pileus trama with a cuticle of narrow (3–5 μ) radially arranged hyphae heavily encrusted with a cinnamon-brown pigment (revived in KOH), beneath this occur scattered enlarged hyphae interwoven with typical filamentous strands but no true hypoderm differentiated; flesh proper hyaline in KOH; universal veil remnants hyaline to sordid yellowish in KOH, filamentous.

Discussion. This is a most unusual species with a veil like that of *C. myceliocephalus* M. Lange (p. 742), but apparently not closely related to it. It very likely belongs in the *C. phaeosporus* group though the fibrillose cuticle is unusual even there. Its spores are among the smallest I have seen in the genus.

COPRINUS PSEUDORADIATUS Kühner and Josserand, Bull. Soc. Myc. Fr. **60**: 26. 1944. (FIG. 13.) Pileus 3–5 mm. high, 3–4 mm. broad when expanded, expanding to plane and 5–7 mm. broad, at first completely covered by a dense hairy-fibrillose universal veil which breaks up into white squarrose squamules and soon disappears, surface grayish white before spores mature, soon becoming lead gray to blackish, wrinkled-striate to the smooth disc, soon splitting radially; flesh very delicate; lamellae free, white, becoming jet black before deliquescing, close, edges white-fimbriate; stipe 2–3 cm. long, 0.5 mm. in diam., equal, white at first, the lower part with recurved fibrillose squamules from the remains of the veil, glabrescent, base slightly tomentose.

Spores black in deposit, 7–8.4 × 4–4.5 μ, blackish revived in KOH, ellipsoid, not flattened, apical hyaline pore small and inconspicuous; basidia four-spored; pleurocystidia and cheilocystidia similar, 40–60 × 10–18 μ, ellipsoid to cylindric; fibrils of the veil of long-cylindric cells 60–90 × 12–18 μ, next to the cap surface the cells often short and ovoid.

Discussion. I first collected this fungus in Nova Scotia, July 27, 1931, in Colchester County. However, only a few caps were collected and a description was withheld pending the collection of more and better specimens. In the meantime Kühner and Josserand discovered it in France. During the summer of 1946 it was collected in the vicinity of the University of Michigan's Biological Station at Douglas Lake. The North American collections have all been from rabbit dung.

COPRINUS PULCHRIFOLIUS Peck, Ann. Rept. N. Y. State Mus. **29**: 41. 1878. (FIG. 16–*type*.) Spores 7–8.4 × 4–4.2 μ, reddish brown, becoming gray in KOH, ellipsoid in face view, slightly curved in side view or merely straight on ventral line and convex on dorsal line, apical hyaline pore distinct; basidia 6–7 μ in diam., four-spored, hyaline in KOH; paraphyses inflated and hyaline in KOH; pleurocystidia none found (careful search made); cheilocystidia none seen (gill edges had apparently deliquesced); gill trama hyaline in KOH; pileus trama hyaline in KOH or slightly yellowish where not revived well, cuticle of globose, hyaline, in-

flated cells; universal veil remnants also of hyaline, more or less globose-inflated cells readily separable from each other.

Discussion. This is one of the Coprini closely related to *C. radians*. A final disposition of it must await a critical study of the group based on numerous collections. I have been able to recognize both species in the vicinity of Ann Arbor.

COPRINUS QUADRIFIDUS Peck, Ann. Rept. N. Y. State Mus. **50**: 106. 1897. (FIG. 17–*type*.) Spores smooth, dark chocolate color revived in KOH, 7.5–9.5 (10.5) × 4–4.5 (5.5) μ, very slightly compressed to terete, ellipsoid in side view, slightly ovoid in face view, apex truncate from a hyaline pore; basidia four-spored (12) 14–16 (18) × 6.5–7.5 μ, hyaline, trimorphic; paraphyses 9–11 × 8–10 μ, vesiculose, hyaline, readily collapsing; pleurocystidia abundant, subcylindric, 100–150 × 20–35 μ, hyaline, thin-walled, readily collapsing, at times extending across the gill cavity; cheilocystidia present at first and 50–80 × 15–25 μ, subellipsoid, soon collapsing; gill trama hyaline in KOH; pileus trama hyaline, cuticle of a layer of hyaline vesiculose cells several cells deep, veil remnants of filamentous hyphae 6–10 μ in diam., clamp connections present.

Discussion. This is one of our best known American species. In none of my collections have spores with a ventral hump or pore been present, and the species is common locally in June. In *C. ebulbosus* this character is quite pronounced. Aside from this one character both appear referable to a single species. The situation here parallels that found in *C. atramentarius*. See *C. variegatus* for further comments.

COPRINUS ROTUNDISPORUS Peck, Ann. Rept. N. Y. State Mus. **31**: 35. 1879. (FIGS. 18–19–*type*.) Spores 8–10 × 6–7 × 7–9 μ, black when first revived in KOH but the dark pigment of the exospore soluble in KOH and gradually dissolving in the mount to a bister solution leaving the spore with a dark bister endospore and a practically hyaline exospore, in side view subellipsoid, slightly flattened, in face view broadly ovate when first revived but when only endospore is colored appearing subcircular, apical hyaline pore broad and distinct, exospore separable from endospore if mounts in KOH are slightly crushed under a cover glass; basidia four-spored, 15–22 × 5–6 μ, hyaline in KOH, difficult to demonstrate and apparently either not projecting or only dimorphic; paraphyses greatly enlarged, 16–20 × 10–18 μ, globose

to ellipsoid, apparently more or less filled with a mucilaginous substance, not collapsing but instead reviving exceptionally well in KOH and very distinct by the manner in which the transmitted light is refracted; pleurocystidia scattered, not coprinoid but instead typically fusoid-ventricose as in most agarics and highly refractive like the paraphyses, 28–36 × 9–14 μ, apices obtuse; cheilocystidia none seen; gill trama hyaline in KOH and reviving well, highly refractive, with a narrow central strand consisting of a few filamentous hyphae, these flanked on either side by subglobular to elliptic highly refractive cells resembling the paraphyses, cap obviously splitting down the backs of the gills along the layer formed by the filamentous hyphae; pileus trama mostly of highly refractive, large, well-revived hyaline (in KOH) cells, cuticle of narrow (4–7 μ) radially arranged hyphae (which may possibly have been veil remnants) also highly refractive and hyaline in KOH; veil remnants filamentous and not sharply distinguishable from those forming the apparent cuticle; no clamp connections seen.

Discussion. This fungus has so many curious microscopic characters for a *Coprinus* that it should be easy to recognize it in spite of the lack of sufficient data on the macroscopic features. The behavior of the pigment in the exospore is unique, the type of pleurocystidium very unusual, and the refractive nature of the paraphyses anomalous.

COPRINUS SEMILANATUS Peck, Ann. Rept. N. Y. State Mus. **24**: 71. 1872. (FIG. 21–*type*.) Spores 12.5–15 × 7–8.4 × 9–12.5 μ, nearly coal black as revived in KOH, flattened, subellipsoid in side view, obscurely angular and broadly elliptic to subcircular in outline in face view, hyaline pore apical and inconspicuous or projecting slightly to form a snoutlike apex; details of gill trama and hymenium not obtainable; pileus trama hyaline in KOH; universal veil remnants of thin-walled readily collapsing globose to barrel-shaped cells.

Discussion. A member of the *Coprinus niveus* group, but a species rather easily distinguished in nature. Both the spore characters and the veil place it here.

COPRINUS SEYMOURII Peck, Ann. Rept. N. Y. State Mus. **28**: 49. 1876. (FIG. 20–*type*.) Spores 6.2–7.8 × 3.1–3.5 × 4–4.6 μ, dull rusty bister in KOH, changing to chocolate-color, flattened, subellipsoid in side view, obscurely triangular in face view, hyaline

pore apical and distinct; basidia hyaline in KOH, four-spored, 5–6 μ in diam.; paraphyses hyaline, inflated, readily collapsing; pleurocystidia none seen (type had been pressed and gills did not revive well); cheilocystidia none seen; gill trama not reviving; pileus trama with a cuticle of vesiculose cells, the walls thickened in the angles at the base and brownish in KOH.

Discussion. A member of the *C. micaceus* series. I have a number of collections which have been referred here, but as yet am not satisfied that the species is more than an extreme variant of *C. micaceus*. If the habitat is truly terrestrial, that should be an aid in distinguishing it, but *C. micaceus* can be very deceiving in this regard.

COPRINUS SILVATICUS Peck, Ann. Rept. N. Y. State Mus. **24**: 71. 1870. (FIG. *22–type.*) Pileus 1–2 cm. high in buttons, 0.5–2.5 cm. across the base when expanding, ellipsoid to subovoid in buttons and then densely pubescent from cystidia, wrinkled-striate to disc but striae extending unequal distances, disc ochraceous tawny to tawny or this color over all when young, striate portion soon ochraceous buff to pale ochraceous buff and very atomate, disc glabrous at maturity, marginal area finally livid and splitting as the spores are shed; flesh very thin and fragile, no odor or taste; lamellae equal, attached at apex of stipe, moderately broad, close to crowded, pallid young, darkening over all before starting to deliquesce, edges white-fimbriate at first; stipe short, 1.5–2.5 cm. long, 1–2.5 mm. thick, equal, margin of cap attached at base but bulb if present soon evanescent (but expansion as in Bulbopodium of *Cortinarius*), densely pubescent at first, finally glabrous, pallid over all or at base slightly sordid.

Spores 11.5–14 × 7–8.4 × 8–9 μ, slightly broader in face view than in side view (slightly compressed), slightly inequilateral in side view, subovoid in face view, apical pore broad, hyaline, prominent and causing apex to appear more or less snoutlike, surface slightly wrinkled from a thin hyaline somewhat deciduous exospore, dark bister to blackish revived in KOH; basidia four-spored, hyaline in KOH, trimorphic; paraphyses inflated, hyaline in KOH; pleurocystidia and cheilocystidia none seen (sections revived poorly); gill and pileus trama dark brown when first mounted in KOH but rapidly clearing to sordid yellowish, cuticle of pileus of vesiculose cells about one cell deep, numerous hyaline, thin-walled, subcylindric to basally ventricose pilocystidia 80–120 × 10–18 μ arising from this layer, their necks greatly elongated and 10–15 μ in diam., their apices rounded to obtuse.

Discussion. The description of the macroscopic characters is taken from numerous collections made by Conners, Groves, and Smith in the vicinity of the laboratories at the Petawawa Experiment Station near Deep River, Ontario, during the season of 1947. In this material the basidia varied from two- to four-spored and the spores 14–20 × 7.5–10 μ. The paragraph on the microscopic data given here was taken from the type. The species stands out as very distinct in the *C. ephemerus* series.

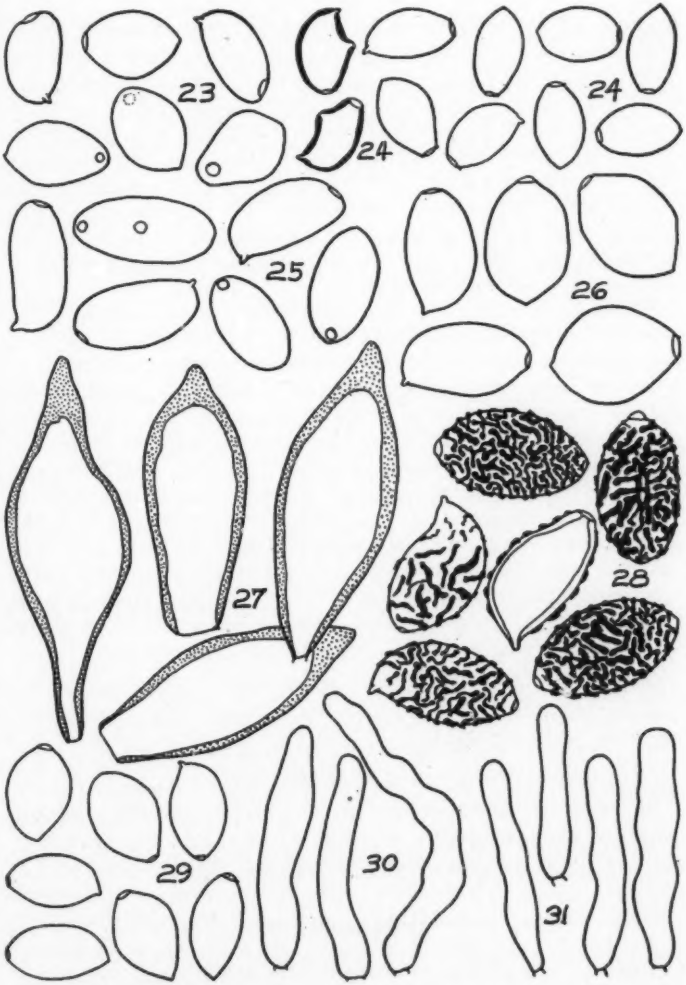
COPRINUS SPRAGUEI Berk. & Curt. Ann. and Mag. Nat. Hist. III **4**: 292. 1859. (FIG. 23.) Spores bister in KOH, 9–11 × 5.5–6.5 × 6.5–7.8 μ, slightly flattened, suboblong in side view, in face view obscurely angular-ovate, base broadly pointed, the hyaline pore distinctly eccentric but small and inconspicuous; basidia hyaline in KOH, four-spored, 18–32 × 6–7.5 μ; paraphyses 14–18 × 9–13 μ, hyaline and inflated; pleurocystidia and cheilocystidia none seen; gill trama hyaline in KOH; pileus trama homogeneous beneath a cuticle formed by a palisade of more or less ellipsoid cells, flesh tawny in KOH just beneath the cuticle in thick sections (material revived poorly and KOH test not truly distinctive), no pilocystidia seen.

Discussion. The microscopic data are taken from a collection Murrill compared with the type at Kew and pronounced identical with it. The species is clearly in the *C. plicatilis* series and distinct because of its smaller spores.

COPRINUS VARIEGATUS Peck, Bull. Buffalo Soc. Nat. Sci. **1**: 54. 1873. (FIG. 24–*type*.) Spores 7–9 (10) × 5–6.2 μ, subellipsoid to ovoid, not flattened, often with a ventral hump or blister (germ pore?), dull cocoa-brown when first revived in KOH, gradually fading to near avellaneous or "wood brown" (possibly immature), apical hyaline pore distinct; basidia four-spored, hyaline in KOH, 14–22 × 5–7 μ, clavate to subcylindric on a short pedicel, trimorphic; paraphyses hyaline, thin-walled, readily collapsing; pleurocystidia cylindric, hyaline, thin-walled, readily collapsing, 60–120 × 15–28 μ; cheilocystidia none seen; gill trama hyaline in KOH; pileus trama hyaline in KOH, cuticle of narrow (4–8 μ) somewhat gelatinous hyphae as revived in KOH.

Discussion. This species is apparently easily distinguished from *C. ebulbosus* and *C. quadrifidus* by the filamentous somewhat gelatinous cuticle. However, further studies on either fresh or very carefully dried specimens of all three are needed to establish this

difference as a valid character. The general aspect of the fruiting bodies and the type of spore remind one of *C. ebulbosus* and *C. quadrifidus*. The white rhizomorphs and peronate-annulate stipe may be additional diagnostic characters.



FIGS. 23–31. Microscopic characters of dark-spored agarics.

Coprinus subpurpureus sp. nov. (FIG. 25–*type*.)

Pileus 1.5 cm. altus, demum 2–3.5 cm. latus, pubescens, purpureo-brunneus vel subpurpureus; lamellae anguste adnatae, confertae, pallidae demum nigrae; stipes 4–10 cm. longus, 1–2.5 mm. crassus, cavus fragilissimus, lilaceo-umbrinus demum pallidus, pubescens; sporae 12–14 × 5.5–6.8 × 7–8 μ.

Pileus 1.5 cm. high, up to 3.5 cm. broad when expanded, finely pruinose-pubescent when young, soon glabrous as cystidia collapse, "natal brown" to "Benzo brown" on disc, "light brownish drab" toward the paler ("light cinnamon drab") broad, striate, marginal area, in age "dark purple drab" over disc and dark gray to blackish over margin; flesh very thin and fragile, delicate, no odor or taste; lamellae narrowly adnate, close, becoming subdistant, narrow, near "tilleul buff," darkening to black over all before the edges deliquesce; stipe 4–10 cm. long, 1–2.5 mm. thick, equal, dull lilac umber young, pallid in age, densely pruinose-pubescent but soon glabrescent, base white-strigose.

Spores black in deposits, 12–14 × 5.5–6.8 × 7–8 μ, smooth, germ pore eccentric, in face view spores with a ventral pore visible (but not humped as in *C. ebulbosus*), narrowly subovate to elliptic in face view, with a suprahilar depression in side view; basidia four-spored, tetramorphic, 18–30 × 6–7 μ; paraphyses hyaline, inflated, not otherwise distinctive; pleurocystidia none seen; cheilocystidia vesiculose to broadly fusoid-ventricose, 10–30 μ in diam.; gill trama very thin and appearing cellular in sections, slightly colored vinaceous brown in KOH (young gills); pileus trama thin and appearing to be a mixture of narrow filaments and enlarged cells, cuticle a single layer of vesiculose to pedicellate cells from which thin-walled pilocystidia 60–100 × 10–16 μ project, layer beneath cuticle lilaceous-brown to sordid vinaceous brown in KOH, clamp connections present.

Gregarious on wet leaves in a springy area, under hardwoods, Colonial Point, Burt Lake, Cheboygan County, Michigan, July 31, 1947. Collected by Margaret Feigley (A.H.S. No. 26158—**type**).

Discussion. This is a very interesting species of the *C. ephemerus* series. The long narrow spores with the eccentric pore, the purplish color particularly in the stipes of young fruiting bodies, and habitat distinguish it from any other *Coprinus* known to me.

PANAEOLUS

PANAEOLUS ANOMALUS (Murrill) Saccardo & Trott. Syll. Fung. **23**: 323. 1925. (FIGS. 26, 27–*type*.) Spores 11–13 (14) × 6–

7 × 7–9 μ, flattened, dark brown (darker than "warm sepia") when revived in KOH, narrowly subovate to elliptic in side view, broadly ovate in face view, some lopsided and some obscurely angled, apical hyaline pore present and distinct; basidia hyaline in KOH, four-spored, 18–22 × 8–9 μ; paraphyses if present remaining collapsed; pleurocystidia abundant, 60–80 × 10–20 μ, apices acute, the walls thickened particularly in the apices which are usually solid, deep yellowish brown in KOH, broadly fusoid to fusoid-ventricose, smooth; cheilocystidia similar to pleurocystidia but smaller (all hyaline thin-walled cells remained collapsed); gill trama sordid yellowish in KOH; pileus trama sordid yellowish in KOH, the cuticle of vesiculose cells and scattered fusoid-ventricose thin-walled hyaline pilocystidia scattered between the vesiculose cells.

Discussion. This species was described as *Campanularis anomalus* by Murrill (Mycologia **10**: 32. 1918). Some authors place the species of *Panaeolus* with brown thick-walled pleurocystidia in a separate genus, *Copelandia,* but in my estimation the group is better regarded as a section of *Panaeolus.*

Panaeolus castaneifolius (Murrill) comb. nov. (FIG. 28–*type.*) Spores 12–16 × 7–8.5 μ, somewhat almond-shaped, obscurely to distinctly verrucose, dark tawny to pale russet when revived in KOH, hyaline apical germ pore present but small and inconspicuous under ordinary magnifications; basidia 24–28 × 10–12 μ, hyaline in KOH, four-spored; pleurocystidia present as dark cinnamon-brown basidia-like or narrower bodies embedded in the hymenium, 18–24 × 6–10 μ; cheilocystidia abundant, fusoid-ventricose to subcylindric, 24–38 × 7–10 μ, neck often flexuous and apices usually obtuse, thin-walled and hyaline; gill trama parallel to subparallel, dull cinnamon-brown when first revived in KOH; pileus trama with a cuticle of clavate, pear-shaped and vesiculose cells arranged into a somewhat irregular palisade, flesh proper floccose, interwoven and pallid to pale brownish when revived in KOH.

Discussion. Microscopically this species is almost identical with *Panaeolus foenesicii,* but the stipe, which is 4–6 mm. thick, the strong odor and unpleasant taste should distinguish it readily in the field. Murrill originally published it as *Psilocybe castaneifolia* (Mycologia **15**: 17. 1923).

Panaeolus fraxinophilus sp. nov. (FIGS. 29–31–*type*.)

Pileus 8–15 mm. latus, conicus demum convexus, siccus et canescens demum udus et hygrophanus, fuscus vel niger, ad marginem Isabellinus; lamellae confertae, latae, cinereae demum nigro-maculatae; stipes 1–2 cm. longus, 1–2 mm. diam., cavus, fragilis, pruinosus, griseo-brunneus; sporae 9–11 × 5–6 × 6.5–7.5 μ. Ad. truncos *Fraxini*.

Pileus 8–15 mm. broad, conic to convex, surface appearing dry and hoary, typically becoming moist and hygrophanous, margin faintly translucent-striate and incurved at first, "fuscous black" to "fuscous" at first, nearly black on disc but soon "Benzo brown," "hair brown" to "drab" (dark gray), at or near margin "tawny olive" to "Isabella color" (sordid yellowish brown); flesh thin, dark, odor slightly farinaceous, taste mild, lamellae, close, moderately broad, adnate, dull drab becoming black-spotted, edges whitish; stipe 1–2 cm. long (up to 8 cm. around stumps), 1.5–2 mm. diam., hollow, fragile, equal, dark grayish brown with a tinge of red, densely pruinose over all and beaded with drops of moisture.

Spores 9–11 × 5–6 × 6.5–7.5 μ, smooth, slightly flattened, narrowly elliptic in side view, ovate in face view, dark reddish brown in KOH, black in mass, apical hyaline pore very small but distinct; basidia four-spored, a few two-spored, hyaline in KOH, 18–22 × 9–10 μ, clavate; paraphyses not differentiated; pleurocystidia none; cheilocystidia very abundant, filamentous and apparently with mucilaginous walls, hyaline, many crooked, 28–42 × 4–5 μ; gill trama regular, pale dull brown in KOH; pileus trama with a dull brown region beneath the cuticle, remainder paler, cuticle of a layer of vesiculose hyaline cells one to two cells deep, numerous hyaline ventricose to subcylindric pilocystidia projecting and measuring 20–44 × 5–6 μ, filamentous in age.

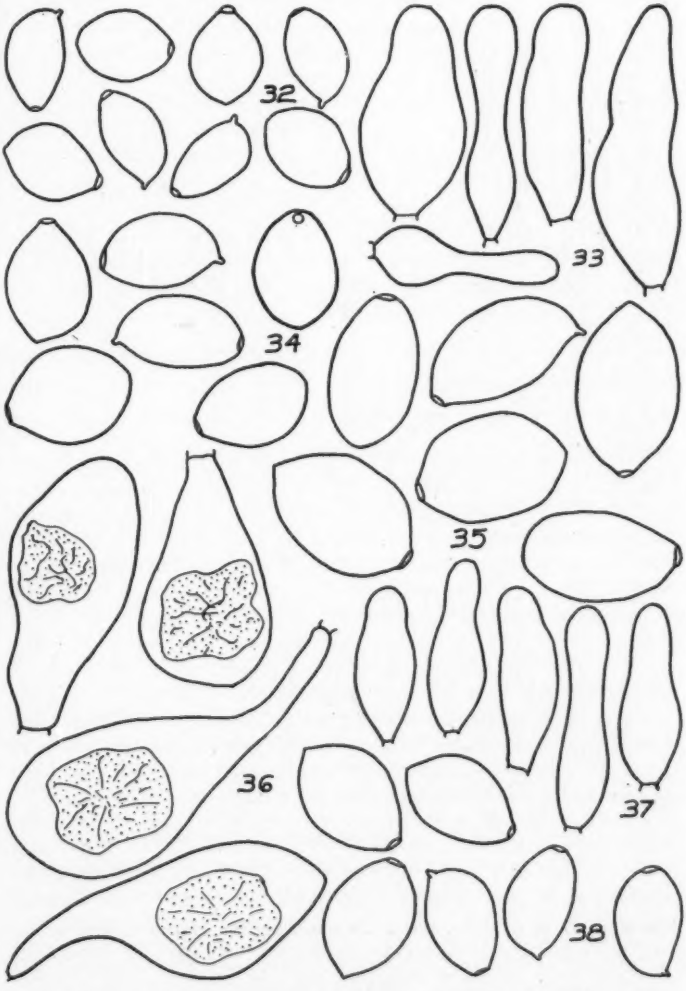
On naked trunk of a fallen ash tree, Warrensburg, New York, September, 1934, A. H. Smith 778–**type**.

Discussion. The combination of relatively small spores and habitat distinguish it from any *Panaeolus* known to me.

PANAEOLUS RETICULATUS Overholts, Ann. Mo. Bot. Gard. **3**: 195. 1916. (FIG. 32–*type*.) Spores 9–11 (12.5) × 5.6–6.2 × 6.5–8 μ, slightly flattened, subelliptic to slightly inequilateral in side view, in face view ovate or a few very obscurely angular, dark bister revived in KOH, apical hyaline pore small but distinct; basidia four-spored, hyaline when projecting but the collapsed hymenium and subhymenium bister in KOH; pleurocystidia none; cheilocystidia fusoid-ventricose with obtuse apices, 18–26 × 8–19 μ, gill trama bister in KOH; pileus trama bister, cuticle not

reviving, apparently of collapsed vesiculose cells. The tissue of the gills and pileus revived poorly.

Discussion. The spores separate it easily from *P. retirugis* and the gray to umber colors from *P. subbalteatus*.



FIGS. 32–38. Microscopic characters of dark-spored agarics.

PANAEOLUS RUFUS Overholts, Ann. Mo. Bot. Gard. **3**: 196. 1916. (FIGS. 33, 34–*type*.) Spores 12–14 × 6.5–8 × 7–9.5 μ, slightly flattened, subovoid to subelliptic in side view, broadly ovate in face view, dark bister in KOH, hyaline pore apical to very slightly eccentric and inconspicuous; basidia hyaline in KOH (some collapsed basidia brownish), four-spored or a few two-spored and then sterigmata abnormal, 20–24 × 10–12.5 μ; paraphyses apparently coprinoid but readily collapsing and basidia so numerous as to obscure them (hymenium in thick sections pale bister); pleurocystidia none; cheilocystidia abundant, hyaline in KOH, thin-walled, fusoid-ventricose to subvesiculose or subcylindric with a broadly rounded slightly enlarged apex, 26–42 × (8) 10–14 μ, in age becoming elongated and with flexuous walls; gill trama parallel, the cells broad and long (60–120 × 15–20 μ), pale bister near and in subhymenium or finally sordid yellowish as revived in KOH; pileus trama sordid yellowish in KOH, cuticle of somewhat enlarged cells but not sharply distinct (as revived) from the remainder of the flesh.

Discussion. This species appears to me to be a synonym of *Panaeolus subbalteatus* as the latter is now understood. The only key character to separate them is the farinaceous odor and taste.

PANAEOLUS SEMIOVATUS (Fries) Lundell, Fung. Exsic. Upsal. No. 537. 1937. Spores 16–22 (23) × 8.5–11 μ, smooth, apices truncate from a hyaline pore, ellipsoid in side view, slightly lemon-shaped to obscurely angled in face or back view, black in mass and dark blackish brown under microscope; basidia four-spored, 32–34 × 12–14 μ; pleurocystidia rare to scattered, clavate to saccate or sometimes mucronate and with an irregular highly refractive content as revived in KOH (cystidia naematolomoid), 28–36 × 10–18 μ; cheilocystidia similar to pleurocystidia or merely fusoid-ventricose and with homogeneous content, thin-walled, hyaline, 26–38 × 7–12 μ, apices obtuse, walls sometimes flexuous; gill trama apparently regular (not reviving well); pileus trama with a cuticle of inflated hyaline cells several cells deep but very soon gelatinous and their outlines difficult to ascertain.

Discussion. Strictly speaking this fungus is not within the scope of this paper, but is included in order that its microscopic details may be more readily discussed in relation to those of other species. It is evident, from a consideration of the aspect of the fruiting bodies and the similarity of the microscopic characters, that this fungus and *P. solidipes* Peck are very closely related.

The similarity in the pleurocystidia of each emphasizes this point. *P. semiovatus* was placed in a separate genus, *Anellaria* (*A. separata* of Karsten), primarily because of the annulate stipe. Lange placed it in *Stropharia*. In view of the similarity in all characters except the annulus between *P. semiovatus* and *P. solidipes* it seems more sensible to me to retain both in the same genus and group them together in a distinct section. A veil is present in many species of *Panaeolus* but in most the remains adhere to the margin of the cap when the latter expands.

PANAEOLUS SOLIDIPES Peck, Ann. Rept. N. Y. State Mus. **23**: 101. 1872. (FIGS. 35–36–*type*.) Spores (12.5) 14–17 × 6–8 × 8–11 μ, flattened, narrowly subelliptic in side view, broadly ovate to obscurely angular-elliptic in face view, very dark bister to blackish in KOH, apical pore hyaline but very small and inconspicuous; basidia four-spored; hyaline in KOH, 20–26 × 12–13 μ; paraphyses not differentiated; pleurocystidia scattered to abundant, 36–54 × 10–20 μ, clavate from a narrow or a short, broad pedicel, hyaline in KOH and with an amorphous mass of a highly refractive substance in the enlarged portion, thin-walled and readily collapsing; cheilocystidia vesiculose, 18–24 × 9–14 μ, also with a highly refractive content revived in KOH; gill trama regular, sordid yellowish as revived in KOH, pileus trama hyaline to sordid yellowish; cuticle of a single row (in sections) of hyaline inflated cells.

Discussion. See *P. semiovatus*.

PANAEOLUS VARIABILIS Overholts, Ann. Mo. Bot. Gard. **3**: 197. 1916. (FIGS. 37–38–*type*.) Spores 11–12 × 6–6.6 × 7.5–9 μ, flattened, subovate to slightly inequilateral in side view, ovate in face view, smooth, not obscurely angular, bister to dark bister as revived in KOH, hyaline apical pore distinct but not large; basidia hyaline in KOH, four-spored (a few with smoky brown sterigmata and some with brownish walls—the latter collapsed), 20–24 × 10–12 μ; paraphyses not distinctly differentiated until late maturity and then readily collapsing (young basidia also somewhat saccate); pleurocystidia none; cheilocystidia abundant, hyaline and thin-walled, fusoid-ventricose to subcylindric, 26–35 × 6–10 μ, elongated and crooked in age, apices obtuse to subcapitate; gill trama bister in KOH; pileus trama with a cuticle of inflated cells about one or two cells deep, these soon collapsing and difficult to demonstrate, flesh proper hyaline to sordid yellowish as revived in KOH.

Discussion. *P. variabilis* most closely resembles the fungus currently known as *P. papilionaceus,* but differs in smaller spores. It needs further study.

PANAEOLUS VENENOSUS Murrill, Mycologia **8**: 186. 1916. (FIGS. 39, 40–*type*.) Spores 10–12.6 (13) × 6–6.5 × 7–8.5 μ, dark bister revived in KOH, smooth, flattened, subovoid to elliptic in side view, not obscurely angular, apical hyaline pore small but distinct; basidia hyaline in KOH when isolated, brownish in thick sections, 18–24 × 7.5–8.5 μ, clavate; paraphyses not distinctive; pleurocystidia present only near gill edges and similar to cheilocystidia; cheilocystidia fusoid-ventricose, 26–38 × 6–10 μ, with a long, often crooked neck above a slightly ventricose basal portion, hyaline or bases brownish in KOH, thin-walled, apices capped with mucilage in some; gill trama bister in KOH, gradually becoming paler; pileus trama dark bister but gradually paler, cuticle formed by a palisade of clavate-pedicellate cells the bases of which are yellowish in KOH.

Discussion. In my estimation this species is not sufficiently distinct from *P. subbalteatus* to be recognized. The marginal belt in *P. subbalteatus* is not a constant character, in fact it is not visible on fresh entirely moist caps or on those completely faded. The spores in Murrill's type are slightly smaller than my measurements for *P. subbalteatus,* but the difference is too slight to be considered important until established from numerous spore deposits.

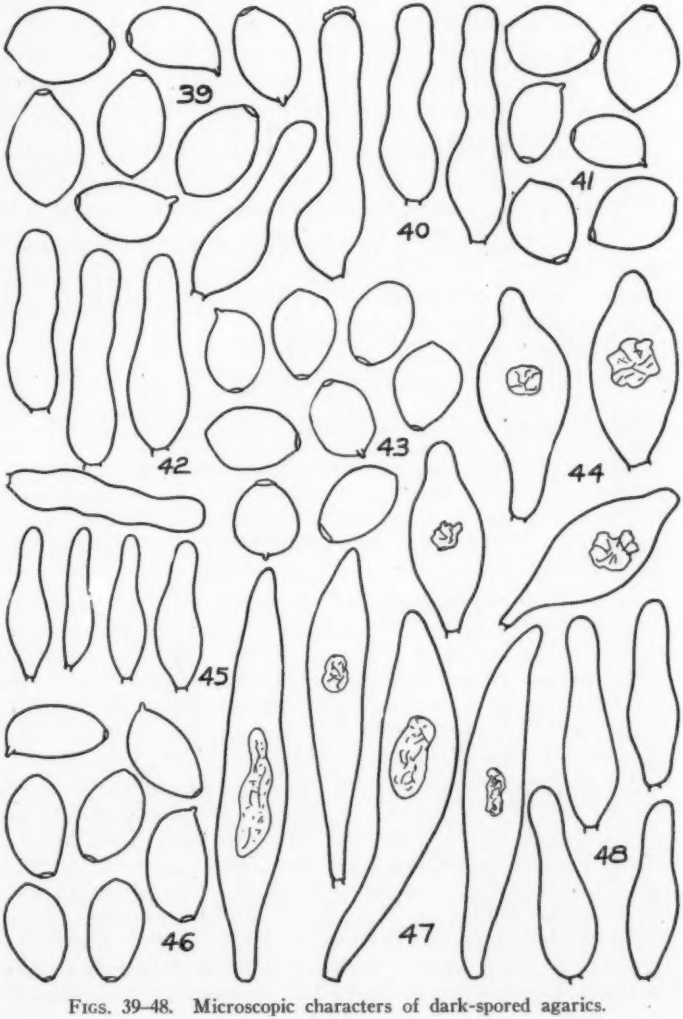
Panaeolus fontinalis sp. nov. (FIGS. 41, 42–*type*.)

Pileus 1–2 cm. latus, obtusus demum late conicus, impolitus vel pruinosus, griseo-olivaceus demum olivaceo-brunneus; lamellae pallide olivaceae demum cinereae et maculatae, confertae, latae, adnatae; stipes 5–10 cm. longus, 1–2 mm. crassus, fragilissimus, pallidus, deorsum argillaceus; sporae 7–9 × 4–5 × 5–6.5 μ.

Pileus 1–2.5 cm. broad, obtusely conic, expanding to broadly conic, surface unpolished to pruinose, "deep olive buff" over disc, paler toward margin, with a "buffy olive" marginal belt, finally "olive brown" or darker over all, fading eventually to "light grayish olive," with a silky appearance in age; flesh very thin and pallid, odor not distinctive; lamellae near "olive buff" young, soon drab, finally mottled with black, ascending adnate, close, broad, usually with 2 tiers of lamellulae, edges at first whitish and slightly floccose; stipe 5–10 cm. long, 1–2 mm. diam., equal, very fragile,

pallid and densely pruinose at apex, darker downward and "cinnamon buff" to "clay color" or tawny olive, pruinose over all at first and beaded with drops, naked in age.

Spores black in deposits, dark bister in KOH, 7–9 × 4–5 × 5–6.5 μ, smooth flattened, broadly ovate in face view, nearly elliptic



FIGS. 39–48. Microscopic characters of dark-spored agarics.

in side view, pore apical and distinct; basidia four-spored, 18–24 × 7–8.4 μ, hyaline in KOH; pleurocystidia absent to scattered (often abundant where insects have damaged hymenium), similar to cheilocystidia; cheilocystidia fusoid-ventricose to subcylindric, 26–34 × 6–9 μ, apices obtuse, neck often flexuous; gill trama pale bister in KOH, the elements more or less interwoven; pileus trama darker than the gill trama, cuticle of a single layer of vesiculose cells, pilocystidia present and similar to cheilocystidia or filamentous and 15–30 × 4–6 μ, hyaline.

Scattered on black muck among liverworts and a species of *Mnium* in a springy area in a cedar swamp, Burt Lake, Cheboygan Co., Mich., during July, 1947. July 4, *25437;* July 5, *25493, 25494* and *25495.* Collection *25437* is designated the **type.**

Discussion. The habitat of this *Panaeolus* is very unusual. A careful search was made for rabbit dung or that of other small animals, but none was found. The habitat, very small spores, and olive buff gills characterize the species.

NAEMATOLOMA

Naematoloma campestre sp. nov. (FIGS. 43–45–*type.*)

Pileus (6) 8–15 (20) mm. latus, obtuse conicus demum campanulatus vel plano-convexus, glaber, lubricus, subcastaneus demum pallide ferrugineus; lamellae latae, adnatae, subdistantes, subochraceae; stipes brevis, 2–3 cm. longus, 1–1.5 mm. crassus, subfibrillosus, deorsum fuscescens; sporae 7.8–9.3 (10) × 4.6–5 × 5–6.7 μ.

Pileus (6) 8–15 (20) mm. broad, obtusely conic, expanding to broadly conic or subcampanulate, finally convex to nearly plane, surface glabrous or with a faint fringe of marginal fibrils when young, lubricous when moist, color "Vernona brown" to "warm sepia" or "auburn" to "pecan brown" on disc, fading first to "pale pinkish buff" or "cinnamon buff" (pale ferruginous), but in age darkening to pale tan, margin striate when moist; flesh pliant, thin, odor very faintly fragrant, taste mild to slightly bitterish; lamellae very broad, horizontally adnate with a decurrent tooth, readily seceding, subdistant (15–18 reach stipe), one tier of lamellulae, dull brown becoming near "snuff brown" to very sordid cinnamon-brown, edges even and not whitish; stipe short, 2–3 cm. long, 1–1.5 mm. thick, equal, cartilaginous-pliant, about "light pinkish cinnamon" over all at first from thin remains of light pinkish cinnamon veil, soon darkening from base upward to concolor or darker than the cap, only somewhat glabrescent.

Spores 7.8–9.3 (10) × 4.6–5 × 5–6.7 μ, flattened slightly, angular-subspheric to angular-ovate or subelliptic with sides ± parallel and with faintly angled shoulders in face view, subelliptic in side view, pore apical but small, pale bister as revived in KOH; basidia four-spored, hyaline in KOH, 18–23 × 7–8 μ, subcylindric; paraphyses basidioid; pleurocystidia nearly embedded in hymenium and originating from gill trama or subhymenium, ventricose-mucronate to fusoid-ventricose and with a highly refractive amorphous body as seen revived in KOH (*Naematoloma* type), 26–34 × 9–14 μ; cheilocystidia hyaline, thin-walled, homogeneous, 18–26 × 4–7 μ, subcylindric to subfusoid-ventricose with obtuse apices; gill trama of subparallel hyphae, pale to rather dark bister as revived in KOH; pileus trama dark bister to sordid cocoa-color in KOH, homogeneous (no differentiated hypoderm or pellicle).

Gregarious on sod in pastures where *Agaricus campestris* is frequently found, definitely not on dung. May 24, 1946, Smith *21426*–**type**.

Discussion. The spore characters and habitat are more like *Psilocybe,* but the pleurocystidia are typical of *Naematoloma.*

Naematoloma humidicola (Murr.) comb. nov. (FIGS. 46–48–*type.*) Spores 9–11 × 5.5–6.3 μ, ovoid in front or back view, ellipsoid to slightly inequilateral in side view, pale tawny in KOH, smooth, apical pore present but very indistinct; basidia hyaline to pale yellow in KOH, four-spored, subcylindric, 23–27 × 5–6.5 μ; pleurocystidia scattered, yellow in KOH, fusoid ventricose to subclavate-mucronate, (44) 50–58 (64) × 8–10 (12) μ, most of them with a highly refractive content, some with what appears to be a wrinkled inner wall, projecting 25–30 μ beyond the basidia; cheilocystidia 24–28 (32) × 5–8 μ, ventricose to subcylindric, hyaline, content homogeneous, thin-walled, abundant; gill trama subparallel, the cells equal in width throughout their length, pale yellow in KOH, subhymenium cellular but very thin and indistinct, pileus trama with a thin pellicle of narrow gelatinous hyphae 2.5–4 μ in diam.; beneath the pellicle is a region of enlarged cells (the hypoderm), the remainder of the flesh filamentous-floccose, all parts pale yellow in KOH, clamp connections present.

Discussion. Murrill described this species as *Naucoria humidicola* (North Am. Flora **10**: 174. 1917). However, its natural affinities are unquestionably in the vicinity of *Naematoloma elongatipes.* It is distinguished among the slender species of *Naematoloma* by the conspicuous, elongated (for this genus) pleuro-

cystidia. In most species in this genus the cystidia do not project appreciably beyond the hymenium.

Naematoloma petasiforme (Murrill) comb. nov. (FIGS. 49–51–*type*.) Spores 8–10 × 5–6 μ, ellipsoid to subovoid, smooth, smoky purple-brown under the microscope when fresh (Murrill), sordid to pale tawny when revived in KOH, with an apical hyaline germ pore; basidia four-spored, subcylindric to clavate, hyaline in KOH, 20–24 × 7–8 μ; pleurocystidia 20–30 × 9–12 μ, mucronate, clavate or fusoid-ventricose and with a highly refractive body of amorphous material in enlarged part; cheilocystidia similar to pleurocystidia or fusoid-ventricose and 20–32 × 8–11 μ with a hyaline homogeneous content, the former rare, the latter very abundant and also occurring near gill edge as pleurocystidia; gill trama regular, tawny brown in KOH, hyphae somewhat interwoven and with encrusted pigment; pileus trama with a cuticle of radially arranged hyphae mostly 4–6 μ in diam. and with clamp connections, the walls with encrusting pigment, some cells of the cuticle barrel-shaped and up to 15 μ in diam. (but no true cuticle of vesiculose cells visible in type), flesh proper floccose and golden tawny in KOH.

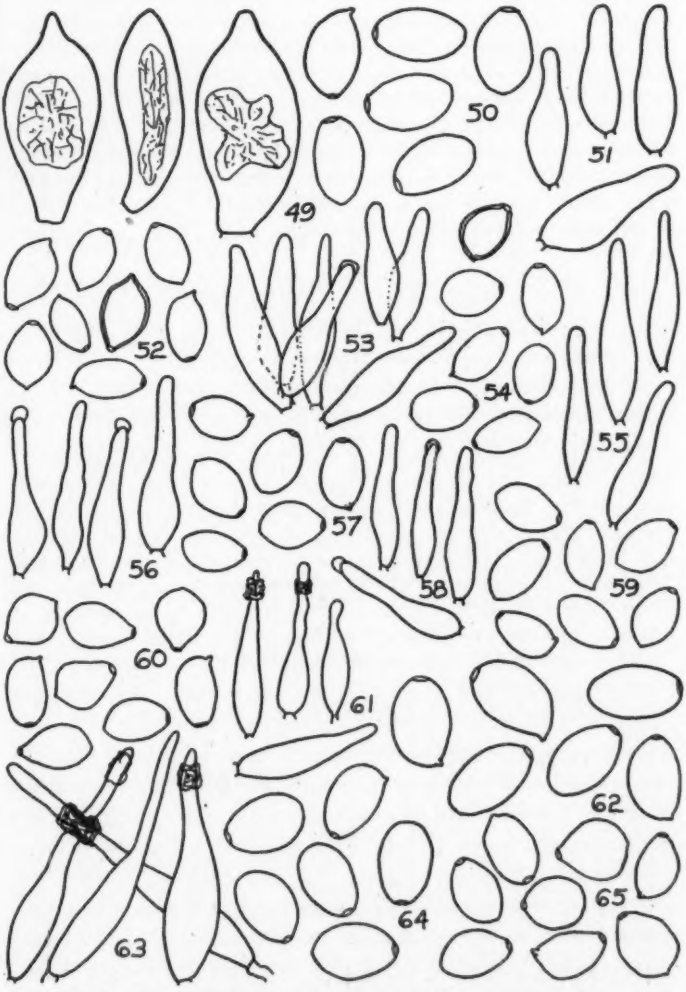
Discussion. Murrill described this as *Psathyrella petasiformis* (Mycologia **14**: 276. 1922). It differs from other members of the *Naematoloma dispersum* series by its lack of a thin pellicle. There are other less striking differences such as the slightly larger spores and possibly a darker spore deposit. However, these cannot be given much emphasis until comparative studies of fresh material can be made and spores from deposits compared.

PSILOCYBE

Psilocybe bulbosa (Pk.) comb. nov. (FIGS. 52, 53–*type*.) Spores 6–7.5 (8) × 3.8–4.2 × 4–4.8 μ, angular-ovate in face view, pointed at base, slightly inequilateral to subovoid in side view, flattened, dull yellowish brown when revived in KOH, with an obscure apical hyaline pore; basidia 20–24 × 6–7 μ, four-spored, hyaline in KOH; pleurocystidia embedded and difficult to locate, 18–24 × 6–7 μ, obtusely fusoid-ventricose, hyaline in KOH, content homogeneous; cheilocystidia abundant, 20–28 × 4–8 μ, similar to pleurocystidia or more elongated, when revived in KOH often with a drop of a mucilaginous substance adhering to apex; gill trama parallel, hyaline to pale brownish in KOH; pileus trama with a thin, hyaline gelatinous pellicle of hyphae 1.5–3 μ in diam.,

and bearing clamp connections, flesh proper of compactly interwoven hyphae, pallid tawny brownish in KOH.

Discussion. The distant gills, angular to ovate spores in face view, and thin gelatinous pellicle appear distinctive. I suspect the



FIGS. 49–65. Microscopic characters of dark-spored agarics.

pale color of the cap as described by Peck was caused by fading. The species was described as *Deconica bulbosa* by Peck (Ann. Rep. N. Y. State Mus. **46**: 107. 1893).

PSILOCYBE CAESPITOSA Murrill, Mycologia **15**: 5. 1923. (FIGS. 54, 55–*type*.) Spores 6.2–7.5 × 4–5.2 μ, smooth, subelliptic in side view, obscurely angular to ovate in face view, terete to very slightly compressed, pale ochraceous tawny when revived in KOH, truncate from a small apical germ pore; basidia four-spored, 16–20 × 6–7 μ, hyaline in KOH; pleurocystidia none; cheilocystidia abundant, 22–28 × 3–6 μ, narrowly fusoid, hyaline; gill trama parallel or nearly so, regular, the hyphae 4–8 μ in diam., sordid yellowish to hyaline in KOH; pileus trama homogeneous beneath a thin hyaline gelatinous pellicle of hyphae 2–4 μ in diam., flesh proper floccose and sordid yellowish in KOH, clamp connections present.

Discussion. This species is very closely related to *P. subviscida* Peck, but differs sharply in the spacing of the gills. Those of Peck's species are subdistant instead of crowded. *P. caespitosa* apparently has a more shaggy-fibrillose stipe and slightly smaller spores in addition, but the latter difference is very slight.

PSILOCYBE CASTANELLA Peck, Bull. N. Y. State Mus. **1**: 7. 1888. (FIGS. 56, 57–*type*.) Spores 6–7 × 3.5–4 μ, subellipsoid to ovoid, not flattened, with a small hyaline apical pore, dull yellowish brown revived in KOH; basidia four-spored, 18–22 × 6–7 μ, hyaline in KOH; pleurocystidia none; cheilocystidia 18–24 (28) × 3–5 μ, hyaline in KOH, subventricose to nearly cylindric, apices obtuse to subacute, apex often with an adhering drop or cap of a hyaline mucilaginous substance; gill trama parallel, yellowish brown in KOH or more tawny next to the subhymenium; pileus trama homogeneous beneath a thin, hyaline, gelatinous pellicle, remainder yellowish brown or toward the subhymenium paler.

Discussion. *Psilocybe californica* Earle (Bull. N. Y. Bot. Gard. **3**: 301. 1904) appears, beyond the possibility of a doubt, to be this species. Its spores are also illustrated (FIG. 59). The habitat on sod appears to be distinctive as is also the habit of growing in rather dense masses. The latter feature is more characteristic of specimens from California. The cheilocystidia (FIG. 58) are also similar.

PANAEOLUS DIGRESSUS Peck, Bull. Torrey Club **22**: 205. 1895. Spores sordid yellowish brown in KOH, 12–14 × 6.8–7.8 × 8–9 μ,

slightly compressed, elliptic in side view, obscurely angled and broadly elliptic in outline in face view, hyaline apical pore small but distinct; basidia 30–35 × 10–12.5 μ, clavate, hyaline in KOH, four-spored; paraphyses not distinct from young basidia; pleurocystidia none, sections of hymenium pale sordid yellowish revived in KOH; cheilocystidia forming a sterile band on gill edge, hyaline, thin-walled, often crooked to contorted, typically fusoid-ventricose to subcylindric, 18–32 × (4) 5–8 μ, apices obtuse and some capped with mucilage; gill trama pale sordid yellowish in KOH, subparallel next to subhymenium, central strand interwoven; pileus trama pale sordid yellowish in KOH except for a more tawny colored region just below the gelatinous cuticle, the hyphae of the cuticle hyaline to yellowish and 2–3 μ in diam., those of flesh proper 6–8 (10) μ in diam.

Discussion. A synonym of *Psilocybe coprophila.*

Psilocybe fuliginosa (Murrill) comb. nov. (FIGS. 60, 61–*type.*) Spores 6–7 × 4.5–5.5 μ, smooth, typically triangular in optical section but varying to ovoid or ellipsoid (as seen in face view), ellipsoid in side view, sordid yellowish brown when revived in KOH, with an obscure apical hyaline germ pore; basidia four-spored, 18–20 × 5–6 μ, hyaline in KOH; pleurocystidia scattered to rare, similar to cheilocystidia; cheilocystidia 16–28 × 4–7 μ, hyaline, narrowly ventricose, the neck flexuous and the apex acute to subacute or in the form of a small knob, many with a highly viscous substance adhering near or on the apex; gill trama parallel, sordid yellowish brown in KOH; pileus trama homogeneous; no pellicle seen, upper region darker yellowish brown in color than that near subhymenium.

Discussion. Dr. Burke has sent me material from Alabama which appears to belong here though the spores vary slightly, being somewhat longer. They range from 6.5 to 8 μ. For *P. fuliginosa* the habitat on bare earth, the dry pileus, shape of spores in face view, and fuligineous cast of the carpophore are apparently distinctive. Murrill described it as *Atylospora fuliginosa* (Mycologia **10**: 25. 1918).

PSILOCYBE GRAVEOLENS Peck, Bull. N. Y. State Mus. **167**: 47. 1913. (FIG. 62–*type.*) Spores 8–10 × 5–6 μ, ellipsoid in face view, in side view subelliptic to slightly inequilateral, smooth, pale sordid ochraceous tawny under the microscope in KOH, apical pore small but distinct; basidia hyaline in KOH, 22–26 × 6–7 μ, four-spored; pleurocystidia rare to scattered, fusoid, 28–32 × 7–

9 μ, the walls slightly brownish in some, hyaline in others when revived in KOH, buried in the hymenium; cheilocystidia hyaline, 12–22 × 7–9 μ, necks 4–6 μ broad and contorted to merely flexuous; gill trama parallel, more or less ochraceous tawny when revived in KOH; pileus trama homogeneous, no pellicle differentiated, floccose, interwoven and pale to dark ochraceous tawny in KOH.

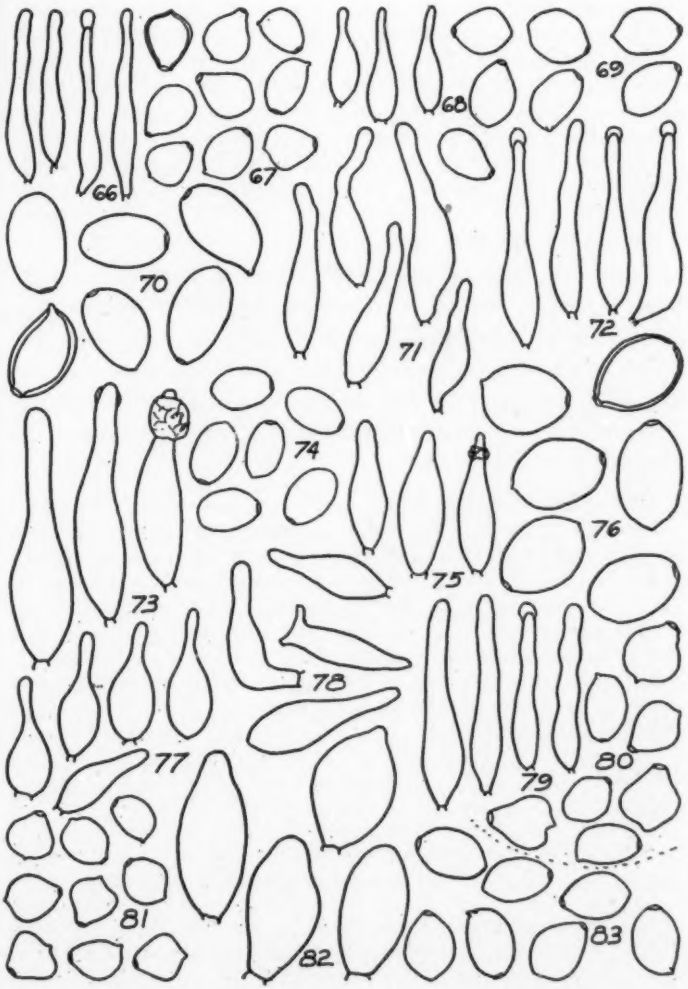
Discussion. The strong odor and clustered manner of growth on soil should be distinctive. The spores are almost identical with those of *P. silvatica,* and I suspect the species belongs in that group even though no bluish or greenish color is reported for it.

Psilocybe lateritia (Murrill) comb. nov. (FIGS. 63, 64–*type.*) Spores ovoid to subellipsoid, terete or nearly so, 7.5–9.3 × 5–6.2 μ, smooth, not angular, dull yellowish brown in KOH, apical pore present but very obscure; basidia 18–20 × 6–7 μ, cylindric, hyaline or in thick sections yellowish, four-spored; pleurocystidia scattered, similar to cheilocystidia; cheilocystidia abundant, ventricose with acute apices but elongating to aciculate, 28–46 × 6–9 μ (narrowest in the longest ones), neck or apex usually with an adhering mass of a highly viscous substance slowly soluble in KOH, content homogeneous and hyaline; gill trama of parallel hyphae, sordid pale yellowish in KOH; pileus trama with a thin cuticle of hyaline to pale yellowish gelatinous hyphae bearing clamp connections, beneath this a narrow region of cinnamon-brown hyphae (in KOH) but not otherwise distinct from the remainder of the flesh which is paler brownish to yellowish.

Discussion. This species was described as *Psathyra lateritia,* by Murrill (Mycologia **10**: 33. 1918). It belongs in the group with *P. atrorufa,* but since this group is in need of a critical study, no attempt at further comparisons will be made here. It is not identical with any of my collections in that group.

PSILOCYBE LATISPORA Murrill, Mycologia **15**: 10. 1923. (FIGS. 65, 66–*type.*) Spores 6.2–7.8 × 4.6–5.2 × 6–6.2 μ, flattened, subovate to subcircular in outline in face view, often slightly angular, in side view slightly inequilateral to subelliptic, dark dull yellowish brown in KOH, apex truncate from an apical hyaline pore; basidia 18–20 × 7–8 μ, hyaline in KOH, four-spored; pleurocystidia none; cheilocystidia 22–26 × 4–7 μ, aciculate to narrowly ventricose, apex at times with a hyaline globule; gill trama regular, hyphae parallel to somewhat interwoven, with dull yellowish brown

walls in KOH; pileus trama homogeneous, surface hyphae slightly gelatinous in KOH but no true pellicle present, floccose, compactly interwoven and with dull yellowish brown walls when revived in KOH.



FIGS. 66–83. Microscopic characters of dark-spored agarics.

Discussion. This species is apparently closely related to *P. phyllogena* Peck but differs in its larger spores.

Psilocybe mammillata (Murr.) comb. nov. (FIGS. 67, 68–*type*.) Spores 5–6 (7) × 4.5–5 μ, smooth, triangular in face view, some ovate-angular, in side view subelliptic to ovate, dull ochraceous tawny revived in KOH, with a small apical pore; basidia hyaline in KOH, 13–15 × 5–6 μ, four-spored; pleurocystidia similar to cheilocystidia; cheilocystidia small and inconspicuous, 12–18 × 4–8 μ, fusoid-ventricose or the apices subcapitate, hyaline; gill trama parallel, pale yellowish bister from a pigment which encrusts the hyphae, darker near subhymenium; pileus trama homogeneous, the hyphae near the surface a darker yellowish brown (bister) than those toward the subhymenium, clamp connections present.

Discussion. Murrill described the fungus as *Psathyra mammillata* (Mycologia **10**: 33. 1918). The spores and cheilocystidia are distinctive. *Psathyra cinchonensis* Murrill (Mycologia **10**: 33. 1918) is identical microscopically with *P. mammillata* and in the dried specimens the gill spacing did not appear distinctive. *Psathyra cinchonensis* is therefore considered a synonym of *P. mammillata*.

Psilocybe modesta (Peck) comb. nov. (FIGS. 69, 72–*type*.) Spores 5.5–6.3 × 3.6–4.2 × 4–4.3 μ, subtriangular to broadly ovate in face view, elliptic in side view, pale bister to sordid tawny revived in KOH, apex truncate because of a small hyaline germ pore; basidia hyaline in KOH, four-spored, 14–18 × 4.5–5.5 μ; pleurocystidia only near gill edge and similar to cheilocystidia; cheilocystidia abundant, hyaline, 22–26 × 3–5 μ, narrowly ventricose, often with drops of a mucilaginous substance adhering to apex; gill trama regular to somewhat interwoven and colored like the pileus trama or paler; pileus trama with a thin poorly formed pellicle of subgelatinous hyphae (in KOH), flesh proper floccose and dark, bright cinnamon in KOH (pale in very thin sections), pigment loosely encrusted on cell walls.

Discussion. In its small spores it resembles *P. mammillata* but the veil is pronounced and the cheilocystidia much longer.

PSILOCYBE NIGRELLA Peck, Bull. N. Y. State Mus. **139**: 28. 1910. (FIGS. 70, 71–*type*.) Spores 9–11 (12) × 6–7.5 (8) μ, dark sordid yellowish brown revived in KOH, smooth, terete, broadly ovoid to ellipsoid, apical pore small and obscure; basidia

four-spored, 22–26 × 7–8.5 μ, hyaline in KOH; pleurocystidia none seen (some collapsed basidia brown); cheilocystidia abundant and forming a sterile band on the gill edge, hyaline, narrowly ventricose to almost aciculate, 20–26 × 4–7 μ, apices often somewhat flexuous; gill trama of long broad parallel cells with parallel walls, pale rusty brown in KOH, subhymenium cellular and dark rusty brown, the pigment encrusted on the cell walls; pileus trama with a gelatinous pellicle of narrow (2–4 μ) hyaline appressed hyphae, beneath this a zone of dark yellowish brown hyphae with the pigment encrusted on the walls, paler toward the subhymenium, the hyphae interwoven and all with broad cells (8–15 μ in diam.).

Discussion. The short stipe is the only character I can find to distinguish it from *P. atrobrunnea,* and length of stipe is a very variable character in bog-inhabiting species.

Psilocybe pallidispora (Murrill) comb. nov. (FIGS. 73–75–*type.*) Spores 5.3–6.2 × 3.5–4.2 μ, terete, ellipsoid to ovoid, with a very small apical pore, dull yellowish brown in KOH; basidia 16–20 × 5–6 μ, four-spored, hyaline in KOH, pleurocystidia scattered, 34–44 × 7–10 μ, fusoid-ventricose with elongated necks and acute apices, the apex or neck frequently with a drop or coating of a highly viscous substance adhering to it, hyaline in KOH, thin-walled, content homogeneous; cheilocystidia 22–28 × 5–7 μ, fusoid-ventricose, in some subcapitate, hyaline in KOH, often with mucilaginous cap; gill trama regular, dark brown (near cinnamon-brown) when revived in KOH; pileus trama homogeneous, no pellicle seen, surface region a darker brown than that toward the subhymenium, pigment encrusted on the walls.

Discussion. Distinct by virtue of the small ellipsoid spores and moderately large pleurocystidia. The pileus is typically dry.

PSILOCYBE PANAEOLIFORMIS Murrill, Mycologia **15**: 12. 1923. (FIGS. 76–78.) Spores 9–11.5 × 6–7 μ, smooth, ellipsoid to subovoid, a few obscurely angular, not compressed, sordid yellowish brown to pale bister revived in KOH, apex truncate from a hyaline apical pore; basidia four-spored, short and fat, 14–16 × 8–9 μ, hyaline in KOH; pleurocystidia none seen; cheilocystidia very abundant and forming a sterile band on gill edge, 12–16 × 4–8 μ, ventricose and with a slender flexuous neck, apices subacute, hyaline in KOH; gill trama parallel to subparallel, pallid, brownish in KOH; pileus trama with a pellicle of narrow (1.5–3 μ) filamentous hyaline hyphae subgelatinous in KOH, a few pilocystidia similar to cheilocystidia projecting from it, beneath this a hypo-

derm of enlarged cells cinnamon-brown in KOH, remainder of flesh also of enlarged hyphal cells but paler, clamp connections present on pellicle.

Discussion. This species appears to be a true *Psilocybe* and closely related to *P. coprophila.* It differs from the latter in terete somewhat narrower spores and short fat cheilocystidia. An imperfect was fruiting over the type and details of cap and gills could not be seen as clearly as desired. However, the data obtained were checked with the Alabama collection which is unquestionably the same.

PSILOCYBE PHYLLOGENA Peck, Bull. N. Y. State Mus. **157**: 99. 1912. (FIGS. 79, 80–*type*.) Spores 5–6.5 (7) × 4–4.6 × 5–6 μ, more or less triangular in face view, often top-shaped or merely ventricose near base, subelliptic in side view, apical hyaline germ pore present causing apex to appear slightly truncate, when revived in KOH sordid tawny brown in color; basidia four-spored, hyaline in KOH, 18–22 × 5–7 μ; pleurocystidia none or present only near the gill edge and similar to cheilocystidia; cheilocystidia narrowly fusoid, apices often with a mucilaginous cap in KOH, content hyaline and homogeneous, 22–26 (34) × 4–6 (7) μ; gill trama regular, parallel or nearly so, pallid brownish in KOH to nearly hyaline; pileus trama homogeneous, no true pellicle present but surface hyphae only slightly gelatinous, flesh proper pallid sordid brownish in KOH, finally becoming nearly hyaline, interwoven and floccose.

Discussion. The lack of a veil in addition to the small compressed spores appears to be distinctive, though the absence of a veil needs to be confirmed from an examination of numerous collections of young carpophores.

PSILOCYBE PLUTONIA (Berk. & Curt.) Saccardo, Syll. Fung. **5**: 1056. 1887. (FIG. 81–*type*.) Spores 5–6.2 × 3.8–4.2 × 5–6 μ, subtriangular in face view to angular-ovate or ventricose basally, often slightly indented around the apiculus, elliptic in side view, distinctly compressed, dull yellowish brown in KOH, with a small apical hyaline pore; basidia pale sordid yellowish to hyaline in KOH, 10–12 × 5–6 μ, four-spored; pleurocystidia and cheilocystidia not seen (no good sections of gill edges obtained); gill trama parallel, dark sordid yellowish brown in KOH; pileus trama homogeneous, dark yellowish brown (near bister) in KOH, no pellicle observed.

Discussion. This species appears to be in the *P. phyllogena* series and is distinct on spore characters alone.

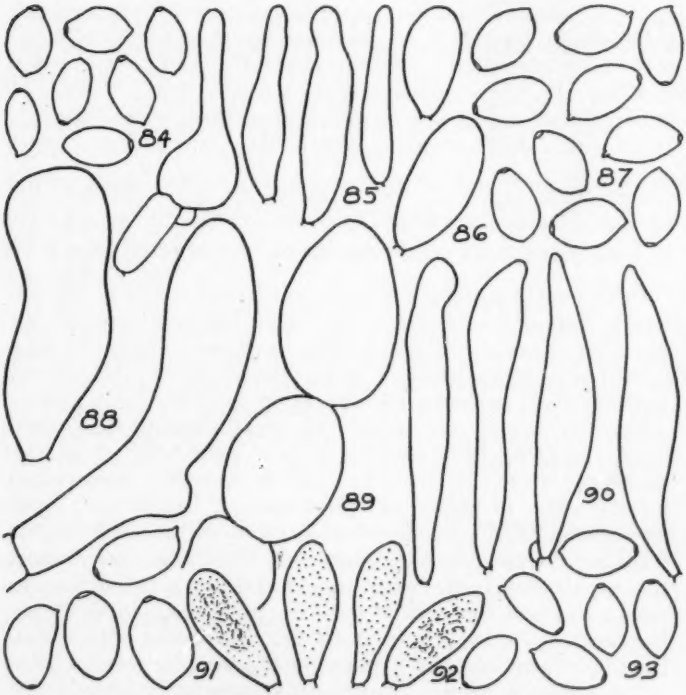
AGARICUS POLYTRICHOPHILUS Peck, Ann. Rep. N. Y. State Mus. **30**: 42. 1878. (FIG. 83–*type*.) Spores 6–7.5 × 4–5 μ, terete, ellipsoid to ovoid, smooth, not angular but an occasional spore ventricose at base, dull yellowish brown in KOH, apical pore present but small; basidia four-spored, 16–20 × 6–7.5 μ, hyaline in KOH; pleurocystidia very rare and similar to cheilocystidia; cheilocystidia 16–23 × 5–7 μ, narrowly fusoid-ventricose with obtuse apices, hyaline and with homogeneous contents when revived in KOH; gill trama parallel, yellowish brown; pileus trama with a thin gelatinous pellicle of hyaline hyphae, flesh proper compactly interwoven and yellowish brown in KOH.

Discussion. I am not sure at present as to the status of this species. Our common *Psilocybe* on *Polytrichum* has no odor and so I am not inclined to consider Peck's type identical with it.

Psilocybe pyrispora (Murrill) comb. nov. (FIGS. 82, 84–*type*.) Spores 6.5–7.5 × 4–4.5 μ, smooth but some obscurely angular, terete, somewhat pear-shaped to ellipsoid or ovoid (angularity best seen in face view, dull yellowish brown when revived in KOH (pale smoky purplish brown in mounts of fresh material —Murrill), apical pore present but small; basidia four-spored, hyaline in KOH, 12–14 × 6–7 μ; pleurocystidia scattered to fairly abundant, 18–26 (32) × 10–15 μ, sessile or with a short pedicel, broadly ovate to elliptic in optical section, hyaline and highly refractive in KOH but content homogeneous, the walls only slightly thickened, smooth; cheilocystidia 18–26 × 4–7 μ, narrowly ventricose to subcylindric, the necks straight or flexuous and apices often capped with mucilage, hyaline in KOH; gill trama not reviving well but apparently subgelatinous in KOH; pileus trama with a broad band of indistinct hyaline hyphae forming the upper region, lower region yellowish brown (upper portion apparently subgelatinous in KOH but details were not distinct).

Discussion. A very curious species by virtue of the pleurocystidia. It is the wall which refracts the light in the characteristic manner, and since the content of the cystidium is homogeneous and hyaline, the species cannot be properly regarded as belonging in *Naematoloma*. Murrill described it as *Deconica pyrispora* (Mycologia **14**: 261. 1922).

PSILOCYBE SUBVISCIDA (Peck) Kauffman, Agar. Mich. p. 275. 1918. (*Deconica subviscida* Peck, Ann. Rep. N. Y. State Mus. **41**: 70. 1888). (FIGS. 85–87–*type*.) Spores 7–8 × 4–4.5 (5) μ, smooth, ellipsoid to somewhat ovoid, not appreciably angular, terete, yellowish brown in KOH, with a small apical germ pore; basidia 18–20 × 6–7 μ, four-spored, hyaline in KOH; pleurocystidia clustered between the gills, rare elsewhere, 34–50 × 7–9



FIGS. 84–93. Microscopic characters of dark-spored agarics.

(10) μ, ventricose, elongating to subcylindric with flexuous necks and obtuse apices, hyaline, thin-walled; cheilocystidia variable, ventricose to ellipsoid at first but soon developing a flexuous projection up to 30–40 μ long and 6–7 μ thick or fusoid-ventricose from the first, the former 20–26 × 10–12 μ at first, 36–50 × 7–10 μ in age, the others usually smaller and 20–32 × 5–8 μ; gill trama regular or nearly so, color not distinctive; pileus trama with a

thin gelatinous pellicle of narrow hyaline hyphae, remainder compactly interwoven and floccose, not distinctively colored in KOH.

Discussion. The occurrence of pleurocystidia between the gills should not be given much emphasis. In many species such structures develop along the line where a new gill is forming and hence they could also be interpreted as cheilocystidia. I suspect that such is the situation here.

Psilocybe tomentosa (Murrill) comb. nov. (FIGS. 88–91–*type*.) Spores 8–10 × 5–6 μ, smooth, slightly compressed to terete, angular to elliptic in face view, slightly bean-shaped to subelliptic in side view, some ventricose basally and with a median constriction (apparently abnormal), dull tawny revived in KOH, apical pore hyaline and very inconspicuous; basidia mostly four-spored, hyaline in KOH; 24–28 × 5.5–7 μ; pleurocystidia rare and embedded in the hymenium, similar to cheilocystidia or shorter; cheilocystidia 34–48 × 5–8 μ, subcylindric to subfusoid, the apices obtuse, broadest at or above the middle and neck very short and indistinct, a few with the apex embedded in a mucilaginous substance; gill trama parallel to somewhat interwoven, pale yellowish in KOH; cuticle of pileus consisting of a turf of upright pilocystidia and chains of ± globose cells with a pale tawny encrusting pigment on the walls, the pilocystidia more or less clavate, 20–52 × 8–12 μ and irregularly arranged so as to project to varying distances above each other, hyaline or with encrusted pigment, the chains of vesiculose cells not highly colored in KOH (as they are in genus *Cystoderma*), masses of vesiculose cells and pilocystidia aggregated into fascicles to form scales on the cap; flesh of cap of interwoven hyphae which are pale yellowish in KOH, clamp connections present.

Discussion. Although the microscopic characters of this species depart radically from those of most psilocybes in respect to the cuticle of the pileus, the differences do not seem to me sufficient to justify erecting a new genus.

PSILOCYBE VIALIS Murrill, Mycologia **15**: 11. 1923. (FIGS. 92, 93–*type*.) Spores pale yellowish in KOH, 7–8.4 × 4–4.6 μ, terete, ellipsoid to somewhat ovoid, some obscurely angular in face view, apex truncate from a small hyaline germ pore; basidia 17–20 × 5–6.5 μ, four-spored, hyaline in KOH; pleurocystidia embedded in hymenium or subhymenium, 20–26 × 8–10 μ, clavate to obovoid above a thick pedicel, brownish in KOH and with a granular content or some with a highly refractive amorphous sub-

stance; cheilocystidia abundant, 20–26 × 4–6 μ, aciculate to narrowly fusoid, hyaline, apex often with an adhering globule of a hyaline viscous substance; gill trama regular, the hyphae somewhat interwoven, pale ochraceous tawny in KOH; pileus trama lacking a distinct pellicle, surface region nearly hyaline, more or less ochraceous tawny toward the gills.

Discussion. The pleurocystidia are not those of *Naematoloma,* and I doubt if the species is any more closely related to members of that genus than are the other psilocybes.

EXPLANATION OF FIGURES

The illustrations of spores, cystidia, and veil elements were drawn with the aid of a camera lucida. As reproduced the spores are approximately 1650 × natural size; the cystidia and veil elements are approximately 700 × natural size unless otherwise stated.

FIGS. 1–9. *Coprinus angulatus:* 1, pilocystidia; 2, spores in side and face view. *Coprinus Brassicae:* 3, spores in side and face view. *Coprinus calyptratus:* 4, spores in both views. *Coprinus asterophorus:* 6, spores in both views. *Coprinus cinchonensis:* 5, cells from veil showing spines; 7, spores in both views. *Coprinus ebulbosus:* 8, spores—some showing ventral hump (or pore). *Coprinus hexagonosporus:* 9, spores in both views.

FIGS. 10–22. The spores are shown in both side and face views. *Coprinus insignis:* 10, spores. *Coprinus jalopensis:* 11, spores. *Coprinus Jonesii:* 12, spores. *Coprinus pseudoradiatus:* 13, spores. *Coprinus laniger:* 14, spores. *Coprinus mexicanus:* 15, spores. *Coprinus pulchrifolius:* 16, spores. *Coprinus quadrifidus:* 17, spores. *Coprinus rotundisporus:* 18, pleurocystidia; 19, spores. *Coprinus Seymourii:* 20, spores. *Coprinus semilanatus:* 21, spores. *Coprinus silvaticus:* 22, spores.

FIGS. 23–31. The spores are shown in both side and face views. *Coprinus Spraguei:* 23, six spores. *Coprinus variegatus:* 24, ten spores, two of which show ventral hump or pore. *Coprinus subpurpureus:* 25, spores. *Panaeolus anomalus:* 26, spores; 27, pleurocystidia. *Panaeolus castaneifolius:* 28, spores. *Panaeolus fraxinophilus:* 29, spores; 30, pilocystidia; 31, cheilocystidia.

FIGS. 32–38. The spores are shown in both views. *Panaeolus reticulatus:* 32, spores. *Panaeolus rufus:* 33, cheilocystidia; 34, spores. *Panaeolus solidipes:* 35, spores; 36, pleurocystidia. *Panaeolus variabilis:* 37, cheilocystidia; 38, spores.

FIGS. 39–48. *Panaeolus venenosus:* 39, spores; 40, cheilocystidia. *Panaeolus fontinalis:* 41, spores; 42, cheilocystidia. *Naematoloma campestre:* 43, spores; 44, pleurocystidia; 45, cheilocystidia. *Naematoloma humidicola:* 46, spores; 47, pleurocystidia; 48, cheilocystidia.

FIGS. 49–65. *Naematoloma petasiforme:* 49, pleurocystidia; 50, spores; 51, cheilocystidia. *Psilocybe bulbosa:* 52, spores; 53, cheilocystidia. *Psilocybe caespitosa:* 54, spores; 55, cheilocystidia. *Psilocybe castanella:* 56, cheilocystidia; 57, spores. *Psilocybe californica:* 58, cheilocystidia: 59, spores. *Psilocybe fuliginosa:* 60, spores; 61, cheilocystidia. *Psilocybe*

graveolens: 62, spores. *Psilocybe lateritia:* 63, pleuro- and cheilocystidia; 64, spores. *Psilocybe latispora:* 65, spores.

FIGS. 66–83. *Psilocybe latispora:* 66, cheilocystidia. *Psilocybe mammillata:* 67, spores; 68, cheilocystidia. *Psilocybe modesta:* 69, spores; 72, cheilocystidia. *Psilocybe nigrella:* 70, spores; 71, cheilocystidia. *Psilocybe pallidispora:* 73, pleurocystidia; 74, spores; 75, cheilocystidia. *Psilocybe panaeoliformis:* 76, spores; 77, cheilocystidia; 78, pilocystidia. *Psilocybe phyllogena:* 79, cheilocystidia; 80, seven spores. *Psilocybe plutonia:* 81, spores. *Psilocybe pyrispora:* 82, pleurocystidia. *Agaricus polytrichophilus:* 83, spores.

FIGS. 84–93. *Psilocybe pyrispora:* 84, spores. *Psilocybe subviscida:* 85, cheilocystidia; 86, cheilocystidia; 87, spores. *Psilocybe tomentosa:* 88, pilocystidia; 89, veil elements; 90, cheilocystidia; 91, spores. *Psilocybe vialis:* 92, pleurocystidia; 93, spores.

AN UNDESCRIBED SPECIES OF HELMINTHOSPORIUM ON SUDAN GRASS AND SORGHUM

C. L. Lefebvre and Helen S. Sherwin

(with 2 figures)

In 1939, G. W. Burton collected and sent us (**7**) leaves of a common Sudan grass × Leoti sorghum hybrid (now Tift Sudan grass), bearing a leaf spot that was defoliating some of his breeding material. Lesions on these leaves varied considerably, the smaller ones being 0.5 to 1.0 mm. in each direction, whereas the longer ones measured up to 15 mm. in length and 1 to 6 mm. in width. The lesions were round to elliptical, the long axis parallel to the leaf veins, and oftentimes the spots seemed to be limited in their spread by the veins. Many of the lesions had coalesced so that comparatively large portions of the leaves were affected (fig. 1, A). The most characteristic features of the lesions, however, were the alternate light tan and darker, more narrow bands of tissue, producing a zonate appearance which suggests the common name "target spot" (fig. 1, A). Lesions were usually surrounded by a narrow tannish-brown border setting off the affected area from the healthy tissue. The symptoms on Tift Sudan grass are strikingly similar to the lesions on corn and teosinte caused by the fungus originally described as *Ophiobolus heterostrophus* Drech. (**5**), but later transferred to the genus *Cochliobolus* (**6**).

Although the fungus causing the target spot of Tift Sudan grass has never been collected on common Sudan grass, the latter was found to be susceptible when inoculated. On common Sudan, however, the lesions appear less zonate (fig. 1, B). The spots are often uniformly dark, or when older they may have a straw-color center surrounded by a reddish-purple border; others have an additional band of straw-color tissue that in turn is surrounded by a dark border. The striking difference in the leaf spots of the two varieties of Sudan grass is in the color because Tift Sudan

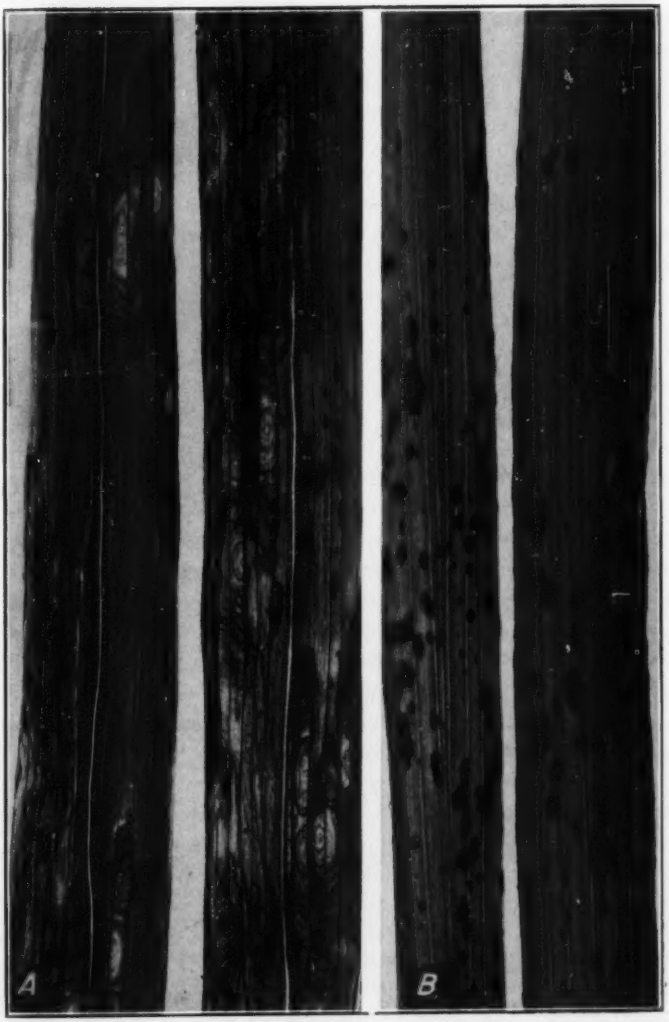


FIG. 1. Target-spot on Sudan grass.

grass has the tan pigment, hence, the tan leaf spot, whereas common Sudan grass contains the dark pigment, hence, the purplish-black lesions.

Under field conditions the fungus sporulates rather sparsely on both the upper and lower surfaces of infected leaves. Furthermore, sporulation is restricted to the dead, brown tissue of the lesions, and this paucity of fruiting may account for the slow spread of the disease. When infected leaves are placed in a moist chamber, however, sporulation is profuse, at first restricted to the lesions but later, as the leaf tissue becomes flaccid, the leaf surfaces may be completely covered with spores.

The conidia of the fungus are usually moderately curved, widest at or near the middle and taper slightly toward the rounded ends, regardless of the host from which they were collected (FIG. 2, A, B, C, D). Although the conidia of this *Sorghum* fungus are golden yellow to light olivaceous, resembling the conidia of *Cochliobolus heterostrophus* (*Helminthosporium maydis* Nisikado and Miyake) in color, they are less strongly curved, smaller, and have fewer septa than the corn fungus. The average number of septa in the conidia of the *Sorghum* fungus is 5.1, whereas in the corn fungus it is 7.7. The greater average number of septa in the conidia of the corn fungus is one of the more striking morphological characteristics that can be used to distinguish this fungus from the one here described on *Sorghum*.

The conidia are borne on conidiophores that usually emerge singly from a stoma, or directly through the epidermis (FIG. 2, D, a), but under favorable conditions two to four may emerge from a single stoma (FIG. 2, D, b). Comparatively few conidia seem to be borne on each conidiophore, there being often only one conidium under field conditions, whereas in a moist chamber two to four are often produced, as indicated by the number of geniculations (FIG. 2, D, a, b). In a moist chamber, or on agar where there is abundant moisture, a conidium borne on the primary conidiophore, and while still attached to it, may germinate and produce a secondary conidiophore bearing one or two conidia (FIG. 2, D, c). This may be repeated, the secondary spore germinating to produce a tertiary conidiophore, which in turn bears one or two conidia, giving the appearance of the conidia being

superimposed and produced in a chain-like manner. These secondary conidiophores are usually much shorter than the primary ones, but the secondary conidia may be as large as the primary ones. This type of conidial proliferation is very characteristic of this fungus and aids in distinguishing it from several other species of *Helminthosporium* that occur on grasses (**4**). In water or on agar, the conidium germinates usually by producing two polar germ tubes (FIG. 2, D, d), and oftentimes a germ tube-like hypha emerges from an attached conidiophore (FIG. 2, D, e).

The fungus grows well on corn-meal and potato-dextrose agars forming a compact mass of aerial hyphae and conidia. As the colony becomes older, sporulation becomes usually more abundant near the margin. On both corn-meal and potato-dextrose agar, the growth is whitish at first, turning light gray or light grayish-brown when the fungus begins to sporulate and later grayish-olive to slate olive (**8**). Small whitish upright tufts of hyphae are sometimes formed within or on the border of the mat. The growth on potato-dextrose agar is more profuse than that on corn-meal agar. When the fungus grows from diseased leaf fragments plated on potato-dextrose agar, the surrounding agar becomes a vinaceous-cinnamon or fawn color. On corn-meal agar the color is much fainter, being light vinaceous-cinnamon when distinguishable. In a solution of carrot decoction plus one per cent dextrose, the fungus grows well, forming a fluffy mat of mycelium on the surface of the liquid. The color of the mycelial mat is white at first and later grayish-olive to slate olive.

TAXONOMY OF THE FUNGUS

Helminthosporium sorghi was described by Schweinitz (**10**, p. 279) in 1832 from decaying leaves of *Sorghum* collected near Lititz, Pennsylvania. Later, Cooke (**3**, p. 141) used the same name for a fungus that he found on *Sorghum* that had been collected by Ravenel and sent to him for identification, which Ravenel issued later as No. 167 of his Fungi Americani Exsiccati. Saccardo (**9**, p. 420), seeing that the specific name had been preoccupied, set up the new name *Helminthosporium cookei* Sacc. Hence, *H. sorghi* Cooke became a synonym of *H. cookei* Sacc.

The writers examined the type specimen of *Helminthosporium sorghi* Schw. from the Schweinitz Collections in the herbarium of the Academy of Natural Sciences of Philadelphia, and were unable to find conidia of a *Helminthosporium*. We also examined what undoubtedly is co-type material, in the Mycological Collections of the Bureau of Plant Industry and in the Farlow Herbarium, Harvard University, and again it was impossible to find conidia. There were, however, black setae of a *Colletotrichum* sp. in typical anthracnose lesions present in abundance on these leaf specimens. Whether Schweinitz observed these setae and mistook them for conidia of *Helminthosporium* cannot be determined now, although he described the *Helminthosporium* "pustules" as being black with conidia that were concolorous. In addition, the lesions on these leaf specimens do not resemble those caused by our fungus, so it seems obvious that the organism causing the leaf spot on *Sorghum* here described is clearly distinct.

We have also examined Ravenel's Fungi Americani Exsiccati specimen No. 167 and found a dark, crust-like, effuse fungus growth on the surface of a *Sorghum* culm. The fungus was superficial, produced no lesions, indicating the organism was probably a saprophyte. A few dark, thick-walled, straight conidia were found that looked wholly different from those produced by our fungus. These conidia were not associated with conidiophores that resemble those of the genus *Helminthosporium*.

Ciferri and Gonzalez Fragoso (2) described *Helminthosporium sudanensis* Frag. and Cif. on the flower parts of Sudan grass [*Sorghum vulgare* var. *sudanense* (Piper) Hitchc.]. Examination of specimens of the above material from the Farlow Herbarium and the Mycological Collections of the Bureau of Plant Industry reveals conidia that are mostly sharply curved, with the central cell larger and darker than the others, and the end cells practically hyaline. According to Boedijn (1), such fungi should be placed in the genus *Curvularia*. Since the fungus on Sudan grass described by Ciferri and Gonzalez Fragoso has, in addition to the above characteristics, conidia that are 4-septate and the conidial measurements agree with those of *C. geniculata* (Tracy and Earle) Boedijn, it is likely that species.

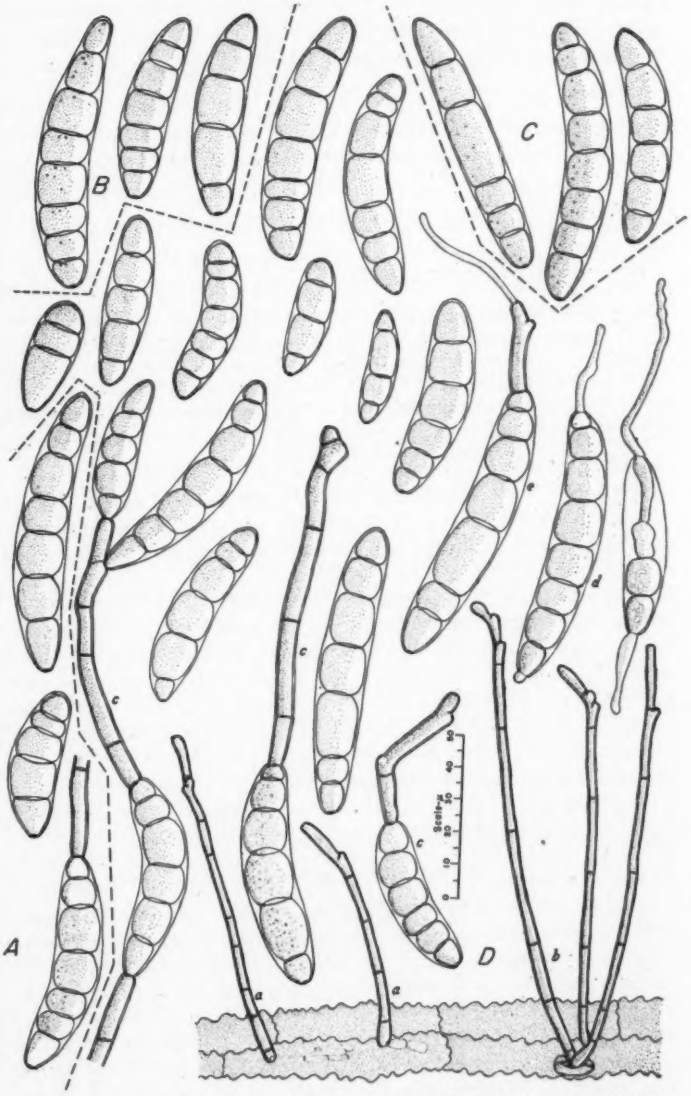


FIG. 2. Conidia and conidiophores of *Helminthosporium sorghicola*.

It appears, therefore, that the fungus that produces the target spot on *Sorghum* spp. described in this paper is widely different from the species of *Helminthosporium* previously reported on these hosts, and we believe it is an undescribed *Helminthosporium*. Since it occurs on several species of *Sorghum*, and because *sorghi* and *sudanensis* have already been used as specific names in the genus *Helminthosporium*, we propose to use the specific epithet *sorghicola* for the new species described hereafter.

Helminthosporium sorghicola sp. nov.

Conidiophoris singulis vel 2–4-caespitosis, typice simplicibus interdum ramosis, olivaceo-brunneis, 5.5–10.5 μ in diam., 115–700 μ longis vel aliquando in madore longioribus; conidiis secundariis vulgaribus, brevioribus, 5–7 μ in diam., 25–200 μ longis; conidiis aureo-flavis usque pallide olivaceis, 20–105 μ × 8.5–20.6 μ, plerumque curvatis, circa medium latissimis et apices rotundatos versus attenuatis, 2–8-septatis, tenui-tunicatis, hilo inconspicuo praeditis.

Hab. in foliis glumisque *Sorghi* spp., U. S.

Producing well-defined spots on *Sorghum* spp., mostly in the Southern United States. Spots small, tan or reddish-purple, depending on host pigment—tan on Tift Sudan grass, reddish-purple on common Sudan grass; older lesions usually show target or zonate pattern, with light centers, surrounded by narrow band of darker tissue, and this bordered by a wider band of light tissue, etc. Lesions range in size from barely visible to 1 × 15 mm.; these may coalesce to involve the whole leaf. Lesions at first round to elliptical, becoming more elongated as they are somewhat limited by the leaf veins. Fruiting of fungus on leaves and glumes sparse under field conditions, abundant when infected tissue is placed in moist chamber.

Conidiophores arising singly or in groups of 2 to 4, usually from stomata or occasionally singly between ordinary epidermal cells; typically simple, occasionally branching; dark, olivaceous brown; measuring 5.5 to 10.5 μ in diameter and 115 to 700 μ in length, sometimes longer under very moist conditions; secondary conidiophores common, especially under moist conditions, shorter, 5 to 7 μ in diameter and 25 to 200 μ in length. Conidia on Tift Sudan grass leaves in moist chamber golden yellow to light olivaceous, measuring 20 to 105 μ × 8.5 to 20.6 μ (means = 59.2 × 14.1 μ), usually curved, widest near the middle, and tapering slightly toward rounded ends; 2 to 8 septa (mean = 5.1); peripheral wall thin; hilum moderately broad, not conspicuous; germinating by the production of two polar germ tubes.

Found on diseased leaves of *Sorghum vulgare* var. *sudanense* (Common) × *Sorghum vulgare* (Leoti) hybrid, Tifton, Ga., February 15, 1939; on leaves of *Sorghum vulgare* var. *sudanense* (Piper) Hitchc. (Tift variety), Gainesville, Fla., August 12, 1942; Tifton, Ga., August 19, 1943 (type), Herb. No. 896; on leaves of *Sorghum vulgare* Pers., Baton Rouge, La., July 1944, and on leaves of *Sorghum halepense* (L.) Pers., Cordele, Ga., August 22, 1945.

In addition to the above, *Helminthosporium sorghicola* has been found on the following specimens in the Mycological Collections of the Bureau of Plant Industry under the name *Helminthosporium sorghi* Schw.; on *Sorghum halepense,* College Station, Texas, fall, 1889, H. S. Jennings No. 80; on *Sorghum halepense,* College Station, Texas, January 10, 1890, H. S. Jennings; on *Sorghum halepense,* Austin, Texas, August, September, October, November, 1900, W. H. Long No. 447; on *Sorghum,* Etheridge, N. C., August 14, 1905, F. L. Stevens No. 404; on *Sorghum halepense,* San Antonio, Texas, July 29, 1910, W. P. C.

The writers wish to express their thanks to Dr. Francis W. Pennell, The Academy of Natural Sciences of Philadelphia, Mr. A. P. D. Piquet, Farlow Herbarium, Harvard University, and Mr. John A. Stevenson, Bureau of Plant Industry Station, for placing pertinent material at our disposal for study; to Miss Edith Cash for preparation of the Latin diagnosis; and to Dr. D. C. Bain, Louisiana State University, for sending a specimen of *Sorghum* M. N. 608.

Type specimens of *Helminthosporium sorghicola* have been deposited in the Mycological Collections of the Bureau of Plant Industry, Beltsville, Maryland, and in the Farlow Herbarium, Harvard University, Cambridge, Massachusetts.

DIVISION OF FORAGE CROPS AND DISEASES,
PLANT INDUSTRY STATION, BELTSVILLE, MD.

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EXPLANATION OF FIGURES

FIG. 1. *Helminthosporium sorghicola* on leaves of A. common Sudan × grass Leoti (Sorghum) hybrid; B. common Sudan grass, × 2.

FIG. 2. *Helminthosporium sorghicola,* drawn with the aid of a camera lucida, A, B, C and D × 500, except D, a, b × 250. A, Conidia from Johnson grass, *Sorghum halepense;* B, conidia from *Sorghum vulgare,* variety Rex; C, conidia from *Sorghum vulgare,* variety M. N. 608; and D, conidia and conidiophores from *Sorghum vulgare* var. *sudanense* (Tift); *a,* single conidiophores emerging directly through the leaf epidermis; *b,* group of conidiophores emerging through a stoma; *c,* primary conidia that have germinated and produced secondary conidiophores and conidia; *d,* germinating conidia, producing polar germ tubes; and *e,* primary conidium having produced a secondary conidiophore, a germ tube-like hypha now emerging from the distal end of this conidiophore.

TWO UNUSUAL FUNGI FROM GLACIER NATIONAL PARK, MONTANA [1]

E. B. MAINS

(WITH 1 FIGURE)

In 1941, the writer spent several weeks in Glacier National Park, Montana. Among the fungi collected, two, *Mesopsora Hypericorum* and *Mitrula gracilis,* were of more than ordinary interest. Both were obtained on the continental divide along the trail from Logan Pass to Hidden Lake at altitudes around 7,000 feet.

MESOPSORA HYPERICORUM (Winter) Dietel

As far as the writer is aware this is the first report of *M. Hypericorum* for North America. The following description has been prepared from the collection.

Uredinia hypophyllous and caulicolous, golden to orange yellow when fresh, whitish when dried, pulverulent, flat to somewhat pulvinate, circular to elliptic in outline, 0.2–0.8 mm. wide, ruptured epidermis fairly conspicuous; urediniospores catenulate in short chains, variable in shape, broadly ellipsoid, obovoid to globoid, 18–24 μ long, 14–18 μ wide, wall colorless, 1.5–2.0 μ thick, moderately verrucose with irregular warts; telia not seen.

On *Hypericum Scouleri* Hook., Logan Pass, Trail near Hidden Lake, Glacier National Park, Montana, September 20, 1941, E. B. Mains (*6121*).

The rust was first described by DeCandolle as *Uredo Hypericorum.* Winter (**16**) apparently first described the telia and placed the species in *Melampsora* because the telia are typical of that genus. For a number of years the rust was treated as a *Melampsora* having only uredinia and telia. According to the Sydows (**14**), Gobi and Tranzschel were the first to note that the uredinia differed in several important aspects from the uredinia

[1] Paper from the Herbarium and the Department of Botany, University of Michigan.

of species of *Melampsora*. Instead of having pedicellate spores and paraphyses as in other species of *Melampsora* the sori lack paraphyses and the spores are catenulate in short chains. Fischer (**5**) also found the same. They concluded therefore that the sori are caeomoid aecia and that the species has aecia and telia and lacks uredinia, and therefore is a melampsoropsis. In support of this interpretation Fischer states that intercalary cells occur in the spore-chain and the sorus is bordered by a slight layer of thin-walled cells suggesting a peridium. In the Montana collection it has not been possible to determine whether intercalary cells occur. Sections through the sori show a slight layer of large thin-walled cells at the margin sometimes extending a short distance upward under the ruptured epidermis. It is questionable that a peridium is formed.

Klebahn (**9**) found uredinia having paraphyses on *Hypericum humifusum* and concluded that they belonged to *M. Hypericorum* and that therefore the species is an autoeumelampsora. However, the uredinia on *H. humifusum* were not associated with any other spore-form and although on the other collections the sori designated as "caeoma" were found with telia the "uredo" sori did not occur. He reports an experiment in which somewhat scanty telial material giving weak germination was sown on several species of *Hypericum, Abies pectinata, Picea excelsa* and *Larix decidua* without results. He expressed considerable doubt concerning his conclusions and in 1914 he (**10**) described the rust on *H. humifusum* as a new species, *Uredo* (*Melampsora?*) *hyperici-humifusi,* and treated *Melampsora Hypericorum* as a melampsoropsis. The Sydows (**14, 15**) in their monograph of the rusts have followed this latter treatment.

Dietel (**2**) has decided that the sori with catenulate spores are uredinia. He points out that they have never been reported associated with pycnia and that they are produced in successive generations during the summer. Also they are similar to the uredinia of species of *Coleosporium* and *Chrysomyxa* which produce aecia on conifers. He concludes that the rust is probably heteroecious with aecia on conifers and with uredinia and telia on species of *Hypericum* and that it belongs in a genus intermediate between

Melampsora and *Coleosporium* for which he proposes the name *Mesopsora.*

The correct interpretation of the sori of this rust and its relationship to other species of the Melampsoraceae cannot be determined with certainty until its life history is worked out through cultures. Until such is done it seems best to follow Dietel's treatment. The absence of pycnia strongly indicates that the sori are uredinial in function. If the rust is an autoecious melampsoropsis as suggested by the Sydows and Fischer it would be necessary to assume that only secondary or repeating aecia (aecidioid uredinia according to Arthur's terminology) have been collected since pycnia have not been reported. Such a species would be unique in *Melampsora.* Since the rust appears to be fairly common in Europe, primary aecia accompanied by pycnia would be expected in some collections. If the rust is heteroecious as suggested by Dietel pycnia would not be expected on *Hypericum.* Also the negative results obtained by Klebahn in cultures of germinating teliospores on species of *Hypericum* would be expected. Since intercalary cells are known to occur in the uredinia of *Coleosporium* (Moss, **11**) their presence as noted by Fischer in the uredinia of *Mesopsora Hypericorum* might be expected.

The Sydows have reported *M. Hypericorum* from Europe, Asia Minor and Africa. It also has been reported from Australia and Japan but such reports may be based on misdeterminations of *Melampsora Kusanoi* Diet. As far as I am aware *Mesopsora Hypericorum* has not been previously reported for North America. Therefore the isolated occurrence of the species on an indigenous species of *Hypericum* is an interesting instance of disjunct distribution.

MITRULA GRACILIS Karsten (FIG. 1, A–E)

In his monograph of the Geoglossaceae of North America Durand (**3**) includes two species of *Mitrula* on mosses, *M. gracilis* Karsten and *M. muscicola* E. Henn. Only a few localities are given for each. *M. gracilis* is listed for Labrador and Newfoundland "attached to and evidently parasitic on *Paludella squarrosa.*" It is stated that Rostrup also has reported the species from Greenland. Apparently the only report of the species for the United

States is that of Seaver (13) who found it "on some species of bog moss in Geneva Creek Canyon, Colorado, at an elevation above 8000 ft." Only one collection of *M. muscicola* was reported by Durand in his monograph "on mossy stems (*Webera nutans*) . . . at about 7000 feet elevation, Laggan, Alberta." In 1915 Durand (4) also collected it "on wet moss at the water's edge, Lake Agnes, Alberta." In the United States it is known only from collections made by Kauffman (8) at Tolland, Colorado, at 9,500 feet and Leal, Colorado, at 8,600 feet. The two species are therefore rare for North America. Durand (4) states that he searched for them carefully but in vain at various points along the Alaskan coasts as far north as Skagway. In the United States only the three collections from Colorado have been made. The writer has sought for them for a number of years without success. However, in 1940 a *Mitrula* was found in moss around the margins of pools near the Hidden Lake Trail a short distance from Logan Pass. The fungus probably was parasitic since it was fruiting in patches of dead moss. The following description has been prepared.

Ascomata capitate, very variable, 10–30 mm. long, the ascogenous portion irregularly globoid, obovoid, ovoid, ellipsoid, reniform, flattened globoid, or occasionally almost cylindric or spathulate, 2–6 × 1.5–7 mm., smooth, convoluted, somewhat cerebriform or ridged when fresh, the ridges and convolutions more pronounced when dry, light orange-yellow to orange-buff (Ridgway) when fresh, darker when dried, cinnamon-rufous, the stipe slender, 1 mm. wide, equal or somewhat wider above, concolorous with the head or somewhat lighter, smooth when fresh, longitudinally furrowed when dried; asci clavate, 60–74 × 6–7 μ, pore staining blue with iodine, the ascospores fusoid-cylindric, 9–12 × 2–2.5 μ, oblique or biseriate, the paraphyses filiform, slightly wider above, 1.5–2 μ, as long as the asci.

Growing in and apparently killing moss, *Aulacomnium palustre* (Web. & Mohr.) Schwaegr. around margins of pools, Trail to Hidden Lake, Logan Pass, Glacier National Park, Montana, 8–20–41, E. B. Mains (*6117*).

The Montana collection is similar to those reported by Kauffman (8) as *M. muscicola* from Colorado. Since he did not give a description the following has been prepared from his collections in the Herbarium of the University of Michigan and from his notes.

Ascomata capitate, 10–20 mm. long, the ascogenous portion obovoid to subgloboid, 3–5 × 3–4 mm., pale ochraceous, darker when dried, even, rugose or lacunose-wrinkled, sharply differentiated from the stipe, the stipe slender, even, creamy-whitish, subpellucid, elastic, glabrous when fresh, yellowish brown and longitudinally furrowed when dried; asci clavate, 65–90 × 6–9 μ, the pore staining blue with iodine, the ascospores fusoid-cylindric, 10–14 × 2 μ, biseriate, the paraphyses filiform, slightly thickened above.

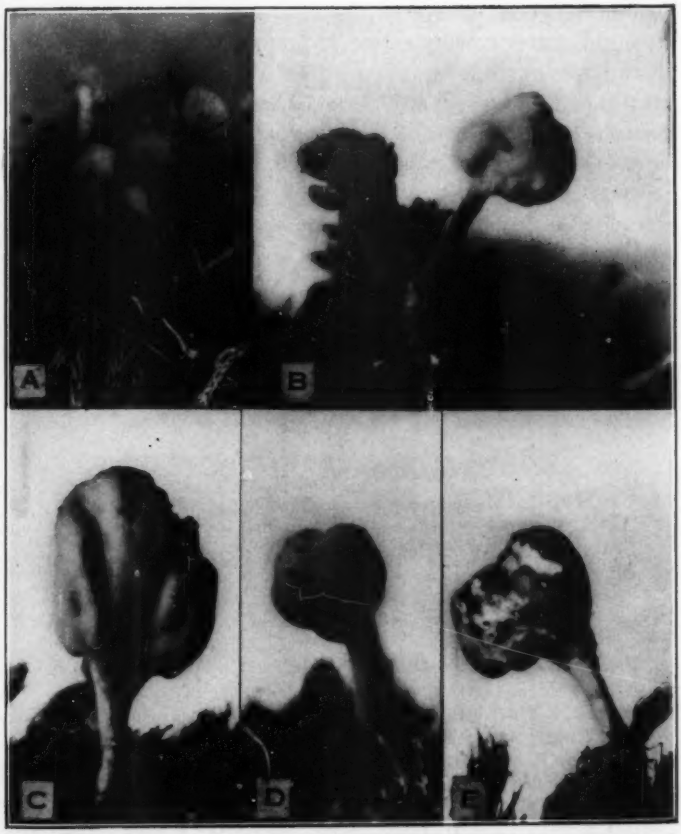

FIG. 1. *Mitrula gracilis* from Glacier National Park, Montana. A. Ascomata arising from moss, approximately 1 ×; B–E. Ascomata showing some of the variations in shape and surface, 5 ×.

Growing on living moss in a swampy ground, Leal, Colorado (8,600 ft.), Aug. 11, 1917, C. H. Kauffman; on mossy stump, Tolland, Colorado (9,500 ft.), Sept. 14, 1920, C. H. Kauffman.

According to Kauffman's notes the stipes of his collections were much lighter in color than those of the Montana collection. When dried they show little if any difference.

Mitrula gracilis and *M. muscicola* do not differ greatly according to the descriptions of Karsten (**7**) and Henning (**6**). In treatments where the species are separately maintained the principal differences noted are that *M. gracilis* has an orange-brown more or less even head and a lighter colored stipe whereas *M. muscicola* has a more convoluted, cinnamon-brown head and concolorous stipe. Such variations may occur within a collection, as in the Montana collection. Although Durand treated them as separate species he did so doubtfully. Seaver also has expressed considerable doubt concerning their separation. Nannfeldt (**12**) in his recent article concerning the Geoglossaceae of Sweden has concluded that they are synonymous. With this the writer agrees. *M. gracilis* appears to have been more frequently collected in Europe than in North America, although it is far from common. Its arctic and high alpine distribution probably accounts to some extent for the few collections.

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SIX NEW INDIAN DISCOMYCETES

EDITH K. CASH

Among specimens of Discomycetes collected by Sultan Ahmad in various localities in India and Pakistan and sent to the writer for examination during the past few months, a specimen of *Dasyscyphella,* two of *Humaria,* and three of *Humarina* appear to differ from any species of these genera that could be found in the literature and are therefore named here as new. Type specimens of these fungi are deposited in the Mycological Collections of the Bureau of Plant Industry, Beltsville, Maryland, and duplicate material of some of them in the herbarium of the collector at Lahore, Pakistan.

1. **Dasyscyphella indica** sp. n.

Apothecia substipitata, ceracea, turbinata, flava, 1–2 mm. diam., margine et extus e pilis echinulatis, hyalinis, 40–50 × 3–4 μ albopruinosa; asci cylindrici, apicibus attenuatis, octospori, 100–120 × 7–8 μ; ascosporae hyalinae, anguste clavatae, multiguttulatae, 35–45 × 2 μ; paraphyses tenues, usque 2 μ inflatae; excipulum hyalinum, plectenchymaticum.

Apothecia substipitate, waxy, turbinate, 1–2 mm. in diameter, hymenium plane, Capucine yellow,[1] ferruginous when dry, exterior concolorous, white-pruinose, margin fimbriate; asci cylindrical, narrowed and with wall thickened at the tips, gradually attenuated to a short pedicel, eight-spored, 100–120 × 7–8 μ; ascospores hyaline, narrow-clavate, multiguttulate, acute at the lower end, often arcuate or sigmoid when free from the ascus, 35–45 × 2 μ; paraphyses numerous, delicate, only slightly enlarged at the tips up to 2 μ; exciple hyaline, plectenchymatous, hairs echinulate, hyaline or subhyaline, 40–50 × 3–4 μ.

On mossy bark of trees, Mussoorie, July 20, 1940, S. Ahmad *434.*

D. indica differs from *Erinella corticola* Mass., described from India (Kew Bull. 1898, p. 115, 1898), in the flexuous, instead of fusoid paraphyses, and from several other somewhat similar species of *Erinella* in the dimensions of the asci and spores.

[1] Except where noted, color readings are from Ridgway, R. Color standards and nomenclature, Washington, D. C., 1912.

2. **Humaria ahmadii** sp. n.[2]

Apothecia sessilia, carnosa, 1–3 mm. diam., rubra, patelliformia; asci cylindrici, octospori, ad apices rotundati, 180–190 × 18–20 μ; ascosporae hyalinae, late ellipsoideae, uniseriatae, verrucosae, 2-guttulatae, saepe solum quatuor maturascentia, 15–20 × 9–12 μ; paraphyses flexuosae, numerosae, ad apices usque 5–6 μ incrassatae; setae paucae, pallide brunneae, subacutae, simplices vel 1–2-septatae, 75–100 × 8–11 μ.

Apothecia sessile, fleshy, 1–3 mm. in diameter, bright red,[3] fading to pale olive gray or nearly white in dried specimens, patelliform, margin nearly even, excipular hairs short, inconspicuous; asci cylindrical, rounded at the apex, gradually attenuated toward the base, eight-spored, 180–190 × 18–20 μ; ascospores hyaline, broadly elliptical, uniseriate, coarsely verrucose, two-guttulate, usually only four becoming mature, 15–20 × 9–12 μ; paraphyses numerous, flexuous, unbranched, enlarged at the tips to 5–6 μ; setae inconspicuous, pale brown, subacute, simple or 1–2-septate, 75–110 × 8–11 μ.

On the ground, Lahore, Pakistan, Nov. 24, 1947, S. Ahmad *2226*.

The very short, inconspicuous setae constitute the most distinctive character of this species. It appears to be close to *Cheilymenia calvescens* Boud., from which it differs in the shorter setae and coarsely verrucose, rather than minutely echinulate spores.

3. **Humaria pallidisetosa** sp. n.

Apothecia patelliformia, carnosa, 6–8 mm. diam., avellanea, margine denticulato; asci cylindrici, apicibus subobtusis, octospori, 200–250 × 13–15 μ; ascosporae uniseriatae, hyalinae, late ellipsoideae, glabrae, 15–18 × 9–11 μ; paraphyses numerosae, granulosae, ad apices 3–4 μ; setae pallidissime brunneae vel subhyalinae, flexuosae, angustae, usque 250–300 × 5–8 μ, glabrae vel minute echinulatae, septatae.

Apothecia patelliform, soft fleshy, 6–8 mm. in diameter, wood brown to drab, drying cinnamon drab, margin minutely denticulate; asci cylindrical, slightly flattened at the tips and narrowed below, eight-spored, 200–250 × 13–15 μ; ascospores uniseriate, hyaline, broadly ellipsoid, smooth, 15–18 × 9–11 μ; paraphyses numerous, granulose, 3–4 μ at the apices; setae very pale brownish to subhyaline, flexuous, narrow, smooth to finely echinulate, septate, narrowed and rounded at the tips, 250–300 × 5–8 μ.

[2] As pointed out by Kanouse (Mycologia **39**: 655. 1947), *Humaria* is the valid generic name under the International Rules of Nomenclature for the species generally known as *Lachnea* or *Patella*.

[3] Ridgway color reading not made on fresh material.

On the ground, Rohtak, Punjab, Jan. 17, 1947, S. Ahmad *1776*.

The fungus is close to *Patella gilva* (Boud.) Seaver in dimensions, but differs from the latter in the nearly hyaline setae and in the color of the hymenium.

4. **Humarina plumbeo-atra** sp. n.

Apothecia cupuliformia, sessilia vel partim immersa, carnosa, glabra, margine leniter crenata, 1.5–2 mm. diam., violaceo-ardosiaca usque plumbeo-atra; asci cylindrici apicibus obtusis, octospori, 130–175 × 12–15 μ; ascosporae uniseriatae, late ellipsoideae, glabrae, utrinque guttulatae, 13–14 × 7–9 μ; paraphyses tenues, ascos superantes, apicibus 2.5–3.5 μ crassis; excipulum ex hyphis tenuibus plectenchymatice intertextis, extus cellulis angulosis 10–15 μ diam. compositum.

Apothecia sessile or partly immersed in soil, fleshy, smooth, margin slightly crenate, 1.5–2 mm. in diameter, hymenium and exterior dark violet slate to plumbeous black, flesh purple when crushed; asci cylindrical, obtuse at the tips, gradually attenuated below, eight-spored, 130–175 × 12–15 μ; ascospores uniseriate, broadly ellipsoid, smooth, with one small guttule at each end, 13–14 × 7–9 μ; paraphyses slender, longer than the asci, gradually enlarged to 2.5–3.5 μ at the tips; exciple composed of fine plectenchyma within, the outer layer of thin-walled, subglobose to angular cells 10–15 μ in diameter.

On the ground beside a water course, Ladhar, Sheikhupura, Punjab, July 8, 1946, S. Ahmad *1640*.

Among the species nearest in color of the hymenium, *Humarina purpurea* Seaver has rough spores, and both *Humaria plumbea* Fr. and *Peziza violacea* Pers. ex Fr. have much larger apothecia.

5. **Humarina umbrina** sp. n.

Apothecia patelliformia usque plana, aliquantus plicata, carnosa, umbrina, 7–8 mm. diam., extus glabra vel minute pustulata, margine subundulato; asci cylindrici, apicibus obtusis, octospori, 200–250 × 11 μ; ascosporae uniseriatae, hyalinae, ellipsoideae, glabrae, 12–15 × 7–9 μ; paraphyses flexuosae, apicibus usque 4–5 μ incrassatis et dense granulosis; excipulum e cellulis tenuibus, subglobosis usque 25 μ diam. compositum.

Apothecia patelliform to applanate, sessile, more or less plicate, fleshy, 7–8 mm. in diameter, hymenium Saccardo's umber, drying sepia, exterior concolorous, smooth to minutely pustulate, margin slightly undulate; asci cylindrical, obtuse at the tips, narrowed below, eight-spored, 200–250 × 11 μ; ascospores uniseriate, hyaline,

ellipsoid, smooth, 12–15 × 7–9 μ; paraphyses flexuous, unbranched, tips swollen to 4–5 μ and filled with fine yellowish granules; exciple of thin-walled hyaline subglobose cells, 25 μ in diameter.

On the ground, Lahore, Pakistan, Nov. 24, 1947, S. Ahmad *2225*.

H. umbrina may be distinguished from *Peziza saccardiana* Cke. by the smooth spores. In *P. sepiatra* Cke. and *P. sepiatrella* Sacc., two species also similar in color, the spores are decidedly longer.

6. **Humarina zizyphi** sp. n.

Apothecia obconica usque turbinata, substipitata, 1–2 mm. diam., margine subundulato, sicco involuto, armeniaco-lutea usque ochraceo-aurantia, sicca daucino-ochracea; asci cylindrici apicibus deplanatis, longe pedicellati, octospori, 100–150 × 13–15 μ; ascosporae uniseriatae, hyalinae, glabrae, oblongo-ellipsoideae, guttulis parvis numerosis impletae, 20–25 × 10–11 μ; paraphyses abundantes, hyalinae, granulosae, ad apices 2–3 μ inflatae, circa 50 μ infra apices ramosae; excipulum subhyalinum e cellulis irregulariter angulosis 15–25 μ in diam. compositum.

Apothecia obconic to turbinate, substipitate, 1–2 mm. in diam., margin slightly undulate and inrolled when dry, hymenium apricot-buff to ochraceous orange, carrot red to ochraceous tawny when dry, exterior concolorous, smooth; asci cylindrical, flattened at the tips, long pedicellate, 100–150 × 13–15 μ; ascospores hyaline, smooth, oblong-ellipsoid, filled with many small oil globules, 20–25 × 11–12 μ; paraphyses abundant, hyaline, granulose, branched about 50 μ below the tips, slightly swollen to 2–3 μ at the tips; exciple subhyaline, composed of irregularly angular cells 15–25 μ in diameter.

On stones and on dead branches of *Zizyphus jujuba*, Ladhar, Sheikhupura, Punjab, Sept. 23, 1941, S. Ahmad *419*.

In the form and size of the spores this fungus resembles *Humarina waterstonii* Seaver described from Bermuda on seeds of *Livistona chinensis* (Mycologia **31**: 533. 1939), but differs from that species in the host plant and in the paler hymenium.

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A STUDY OF THE TEMPERATURE AND HUMIDITY REQUIREMENTS OF ASPERGILLUS NIGER[1]

JOHN TYLER BONNER

(WITH 3 FIGURES)

There are a number of reasons why the temperature and humidity relations of fungi are important. First they are of physiological interest for they affect and limit the fundamental processes of growth and development. Also, of a more practical nature, they both provide information helpful in the problem of fungus or mildew control, and they are useful in laboratory tests of vulnerability or resistance of items to fungus attack, where the optimum conditions of temperature and moisture must be known.

Aspergillus niger was chosen as the organism for this study both because of its widespread occurrence and because of its frequent use as a test organism. (The latter is especially true of the strain chosen: United States Department of Agriculture No. Tc 215–4247.)

MATERIALS AND METHODS

The technique used was basically that of Galloway (**1935**). Briefly, small squares of cellophane streaked with fungus spores were suspended on threads over solutions of different concentrations of calcium chloride, giving atmospheres of different relative humidities. Since details of the methods play an important role in the reproducibility of results, they will be described here.

Aspergillus niger was grown in Petri dishes on the following media: Dextrose, 30 gm.; $NaNO_3$, 30 gm.; K_2HPO_4, 1.0 gm.; $MgSO_4$, 0.25 gm.; KCl, 0.25 gm.; agar, 15 gm.; distilled water,

[1] This study was carried out during the war as part of a tropical deterioration research program at the Aero-Medical Laboratory, Wright Field, Dayton, Ohio.

The author wishes to express his gratitude for the invaluable technical assistance of Mrs. Roberta Dingwall.

1000 ml. (pH adjusted to 6.8). The spore load was obtained from cultures that had grown at room temperature from seven to fourteen days.

The squares, onto which the spores were placed, were made

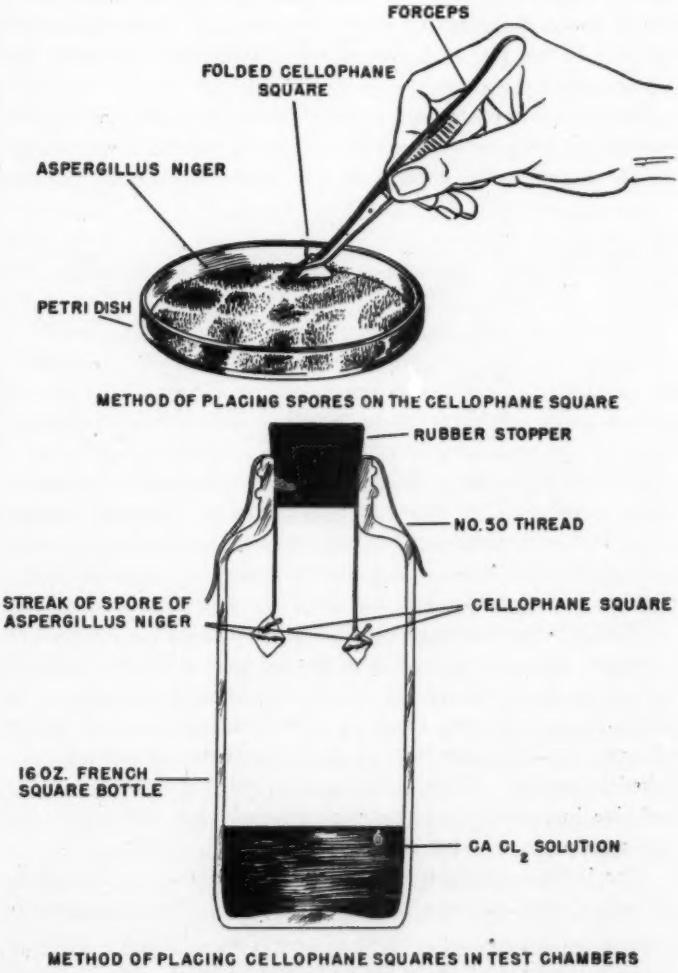

FIG. 1. Diagram illustrating the technique used.

from strips of cellophane [2] which had been immersed in five per cent malt extract (Difco) solution for ten minutes, dried in room air, and cut into squares 1 × 1 cm. Each square was strung onto a piece of number fifty white cotton thread and held by a simple knot. They were not sterilized because the germinating spores could always be identified as *Aspergillus niger* under the microscope. In the few instances where contaminants appeared, the squares were discarded.

To place a streak of spores on a square, the cellophane square was folded back so that two corners met and the fold was brought in contact with the surface of the fungus culture. This fold, studded with spores, was then rubbed gently against a piece of filter paper to even their distribution. The inoculated squares were than suspended over various concentrations of calcium chloride solution in 16 oz. French square bottles so that there were 4 squares in each bottle (FIG. 1).

TABLE 1

CONCENTRATION OF CALCIUM CHLORIDE SOLUTIONS (AS DETERMINED BY THE HARVEY (1910) METHOD) AND THE ESTIMATED RELATIVE HUMIDITY OVER THESE SOLUTIONS (OBTAINED FROM DATA OF THE DOW CHEMICAL COMPANY)

Concentration of Solution	Estimated Relative Humidity
26.5%	70%
21.9%	78%
17.1%	85%
10.0%	93%

Four different concentrations of calcium chloride solutions were prepared and each solution was divided so that 30 ml. were dispensed in a number of the 16 oz. French square bottles. The concentrations of the solutions were carefully checked by the Harvey (1910) technique. From information generously supplied by the Dow Chemical Company (1945) it was known what relative humidities could be expected over such solutions. This information is recorded in table 1.

The bottles containing the squares were placed in an incubator in which a fan had been installed to ensure constant temperatures

[2] The cellophane used was Du Pont PUT-O (30 gms. per square meter) which has received no special surface coating treatment of any sort, but is merely pure, regenerated cellulose.

and to prevent any temperature gradients. The length of time for the temperature inside a French square bottle (kept at room temperature, 24° C.) to reach equilibrium with the oven temperature was determined. By use of thermocouples it was found that at the near extreme incubator temperature of 45° C., in one-half hour the temperature inside the bottle was 1° C. low, and in one hour it had reached the incubator temperature.

The technique for making the germination observations was to remove a square from the bottle and fix the spores on the cellophane for staining by holding the surface containing the spores over steam rising from boiling water for about one-half to one minute. The square was then immersed in Linder's Lacto-phenol-cotton-blue, which was used as a mounting and staining fluid, and heated gently on a slide, under a cover-slip, to flatten out the cellophane.

The germination times were established by making stained preparations of replicates of any one experiment at different intervals of time approaching the expected germination time as determined by preliminary tests. The four sets of slides of each determination were carefully examined microscopically and an estimated germination time was established. The times are expressed $a \pm b$. The a indicates the most probable time; $\pm b$ the range of time within which germination certainly occurs (TABLE 2).

In this study "germination" is defined as that stage of development where the sides of the germ tube are first parallel, and "germination time" is defined here as the length of time required for at least ten spores to germinate on a cellophane square. This is contrary to the procedure used by many (see, for instance, Wellman and McCallan, **1942**) where the per cent germination is plotted against time, and "germination time" is arbitrarily chosen as the time when fifty per cent, or some other per cent, germination has occurred. The reason for not using such a method is twofold: (1) it is difficult to get an even distribution of spores on the cellophane squares when using Galloway's (**1935**) technique, which is necessary to establish per cent germination, but more important, (2) from the practical point of view it is of greater value to know when the first spore germination will occur than to know the average time for all spores. This point was clearly shown, when in some

instances the per cent germination remained extremely low, but the few that did germinate grew and sporulated. (For example see figure 3, F.)

RESULTS

The germination time of *Aspergillus niger* USDA No. Tc 215–4247 was determined at 10°, 20°, 30°, 40°, 45°, 50° C. and at the following relative humidities for each of those temperatures: 100%, 93%, 85%, 78%, 70%. Most determinations were checked in at

TABLE 2

GERMINATION TIME OF *Aspergillus niger* AT DIFFERENT TEMPERATURES AND RELATIVE HUMIDITIES

Temperature in °C.	Relative Humidity	Estimated Germination Time in Hours	Number of Experiments Performed
10	100	>100	1
20	100	12 ±1	4
20	93	12 ±1	4
20	85	17 ±3	4
20	78	>100	1
30	100	4 ±1	4
30	93	5.5±1	4
30	85	9 ±1	4
30	78	48 ±3	4
30	70	>100	1
40	100	5.5± .5	4
40	93	3.5± .5	4
40	85	8 ±2	4
40	78	33 ±3	4
40	70	>100	1
45	100	17 ±5	2
45	93	7 ±2	4
45	85	9 ±2	4
45	78	50 ±5	2
45	70	>100	1
50	100	>100	1

least four separate experiments. This checking was found necessary after preliminary experiments which showed that the variability of results was large. However, in a few instances the results were sufficiently definite to warrant fewer checks. The data from these experiments are recorded in table 2.

In order to appreciate fully the results given in table 2 they must be displayed in the form of a graph, but since there are three variables, ideally a three-dimensional graph is required. Taking heart from the ecologists (see Shelford, 1929) who have been confronted with the same problem, a two-dimensional graph has been

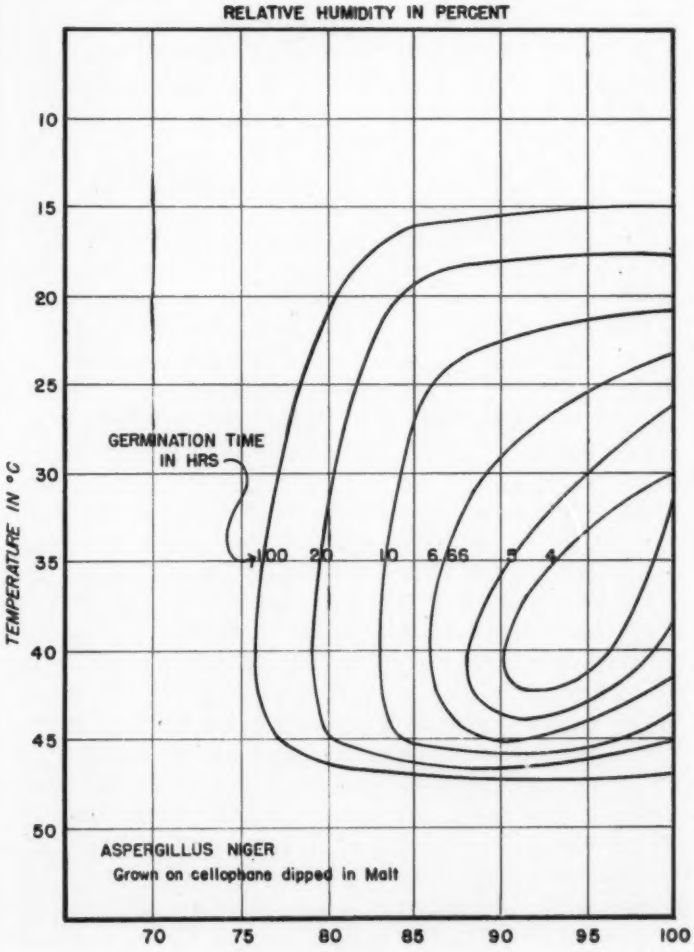

FIG. 2. Germination curves.

drawn (FIG. 2) in which the abscissa is relative humidity, the ordinate temperature, and "germination time" is represented by a family of curves.

The salient characteristics in relation to temperature and humidity that can be observed for *Aspergillus niger* in figure 2 are primarily the following: the optimum conditions for growth are at a relative humidity near 93 per cent, and at a temperature near 40° C; at 100 per cent relative humidity the optimum temperature is near 30° C. Thus we find that the optimum condition for growth for this species is not at saturation and that the optimum temperature varies with different humidities.

It should be clearly understood, when interpreting the graph in figure 2, that for two reasons the accuracy of the curve is limited: (1) as stated above the points on the graph are the "estimated" germination time within a range of time where it is certain germination occurred. Although these "estimated" points are believed to be fairly accurate, they are to a limited extent arrived at by human judgment and not entirely by objective measurement. (2) There are relatively few points on the graph and therefore there has been a considerable amount of interpolation and extrapolation and the possible error is multiplied by the fact that it is in three dimensions.

During the course of these experiments it was noted that the different conditions imposed on the germinating spores of *Aspergillus niger* definitely affected its morphology. It was especially true that under extreme conditions abnormalities in pattern occurred. These abnormalities were of two types. One occurred at high temperature, 45° C., and at high humidities, 100 per cent and 93 per cent, where the spores were greatly swollen (FIG. 3, A). Under optimal conditions slight swelling occurred (FIG. 3, B), but in these extreme cases the spore swelled to over ten times its normal volume. This swelling in no way prevented germination, as evidenced in figure 3, A. At a higher temperature, 50° C., where no germination occurs, there was no evidence of any swelling, in fact the spores showed signs of degeneration. The second type of abnormality appeared at low relative humidities, 70–78 per cent at all viable temperatures. In these instances the spore appeared to be of normal diameter, but the germ tube was enlarged (FIG.

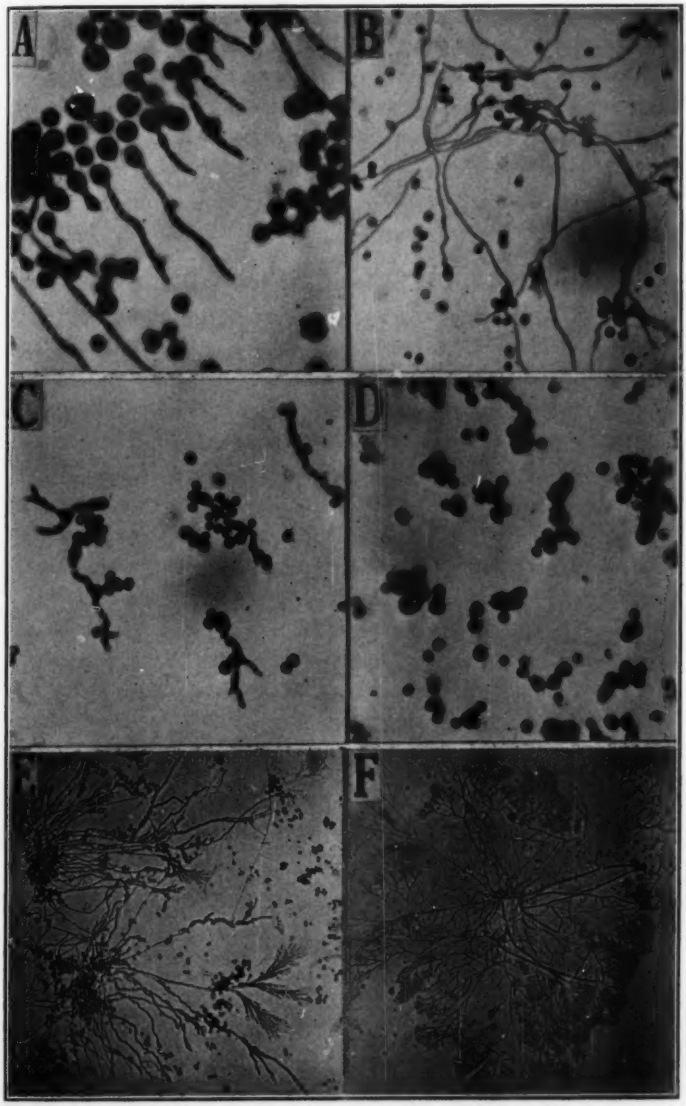

FIG. 3. Germinating spores.

3, C), sometimes even spherical (FIG. 3, D), rather than the normal thread-like construction. If the experiment was allowed to run for extended periods of time, often different types of peculiar segmented, flat, fanlike hyphal clusters resulted (FIG. 3, E, F). This apparently does not inhibit sporulation, as seen in figure 3, F where a sporangiophore rises from the center of the abnormal mycelium.

DISCUSSION

A comparison has been made between the results obtained here on *Aspergillus niger* with those to be found in the literature. Very little complete work has been done on the temperature and humidity requirements of any one fungus. Although Groom and Paniset (**1933**) give some data, the only work I have found that is sufficiently parallel to this study so that comparisons can be fruitfully made is that of Tomkins (**1929**).

Tomkins made detailed studies of two fungi: *Alternaria citri* and *Trichoderma lignorum*. His results, which are essentially similar for both of these fungi, differ in three major respects from *Aspergillus niger:* (1) The optimum relative humidity for Tomkins' fungi is 100 per cent, whereas for *Aspergillus niger* it is nearer 93 per cent. (2) In his fungi the optimum temperature is the same for all relative humidities, which is not true for *Aspergillus niger*. (3) In his fungi the temperature minimum becomes lower the higher the relative humidity, whereas in *Aspergillus niger* the temperature minimum is approximately constant between relative humidities of 85 to 100 per cent.

The reason for these major differences could be found in a number of directions. Tomkins' technique is very different—for instance he measures growth rate instead of germination time. Furthermore his actual testing conditions differ radically from those used here.

But also it is quite conceivable that different fungi vary in their response to temperature and humidity. To examine this point a survey was made of the minimum, optimum and maximum temperatures and humidities of numerous fungi. Briefly the following information on temperatures was obtained:

In a fairly representative group of mildews the range of minimum temperature for forty-four fungi is from − 6° C. to 15° C., the range of optimum temperatures for fifty-one fungi is from 10° C. to 45° C., and the range of maximum temperatures for thirty-two fungi is from 25° C. to 51° C.

Similar data on humidities show that the minimum relative humidity for fifty-eight fungi is from approximately 70 per cent to approximately 98 per cent. Furthermore, the frequency distribution of minimum relative humidities for the fifty-eight fungi is fairly even between the limits of the range.

We have then ample evidence that fungi differ greatly in their response to temperature and humidity.

Unfortunately the basic problem of how temperature and humidity affect the processes of growth and development in any fungus, and what it is in different fungi that is affected so specifically by these environmental conditions, remains completely obscure. If anything is indicated it is that the relationship between the three variables, (1) species of fungus, (2) temperature, and (3) humidity, must be extremely complex. The results on *Aspergillus niger* will serve only to expose more fully the fundamental problem though their practical value will be more immediate.

SUMMARY

The combined temperature and relative humidity requirements of *Aspergillus niger* were studied with the following results: The optimum conditions for growth are at a relative humidity near 93 per cent and at a temperature near 40° C.; at 100 per cent relative humidity the optimum temperature is near 30° C. Thus for this species the optimum condition for growth is not at saturation and the optimum temperature changes with different humidities.

A general survey of the literature shows that the variability among fungi in their response to temperature and humidity is great, indicating that there is no simple temperature-humidity relationship for fungi.

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EXPLANATION OF FIGURES

FIG. 2. Graph showing the effect of temperature (ordinate) and relative humidity (abscissa) on the germination time (family of curves) of *Aspergillus niger*.

FIG. 3. Photomicrographs showing the effect of different combinations of temperature and humidity on the morphology of the germinating spore of *Aspergillus niger*. *A.* (300 ×) Spores germinating at high temperature (45° C.) and high relative humidity (100%). *B.* (300 ×) Spores germinating under optimal conditions (40° C., 93% RH). *C, D.* (300 ×) Spores germinating at low relative humidities (70–78%) and optimal temperatures (30–40° C.). *E, F.* (75 ×) Growth obtained if the fungus is kept for an extended time (3–5 weeks) under dry conditions (70–78% RH) at an optimal temperature (30° C.). Note how the hyphae spread out into fan-like processes and that in *F* normal sporangiophores can be seen.

TWO SPECIES OF COPRINUS WITH NOTES ON THEIR CULTURAL CHARACTERS

MORTEN LANGE [1]

(WITH 4 FIGURES)

The present paper deals with two species of *Coprinus;* the one being identified with a previously described but little known species, the other believed to be previously undescribed. Both have been grown in culture and notes are given about their cultural characters. The descriptions, however, are drawn from material grown under natural conditions, if not otherwise stated.

COPRINUS COTHURNATUS Godey ap. Gillet 1878. (FIG. II, III)

Pileus 1.2–2.0 cm. high before expanding, ovate, subovate, expanding through campanulate to almost flat, slightly umbonate, edge recurving and splitting irregularly; whitish then grayish, plicate-striate nearly to the centre, disc not sharply delimited. Veil rather prominent on young specimens, of a dense, granulose to somewhat filamentous covering (especially towards the margin, which on young buds is connected with the stipe by fibrils), dingy whitish, in places with a reddish avellaneous tinge (conf. below), on mature specimens left as a few scurfy, brownish patches on top of cap. Flesh very thin, watery white. Lamellae free, narrow, rather crowded, with a varying number of smaller ones between; white, turning black over all (through pale pinkish cinnamon); spores ripening simultaneously, edge floccose, remaining white until deliquescing. Stipe 5–6 cm. long, 3–5 mm. thick, terete or slightly compressed, attenuated upwards, white, scabrose-tomentose from short fibrils (very much so towards the base which is also covered with distinct, granulose veil-remnants and tinged reddish avellaneous), distinctly hollow, not fragile. Odor and taste nauseating, somewhat like *Coprinus narcoticus,* rather pronounced. Sporeprint black.

[1] University of Copenhagen, Botanical Laboratory. The main part of this work was carried out while the author was studying in the laboratory of Dr. A. H. Smith, University of Michigan Herbarium, Ann Arbor, Michigan, United States of America.

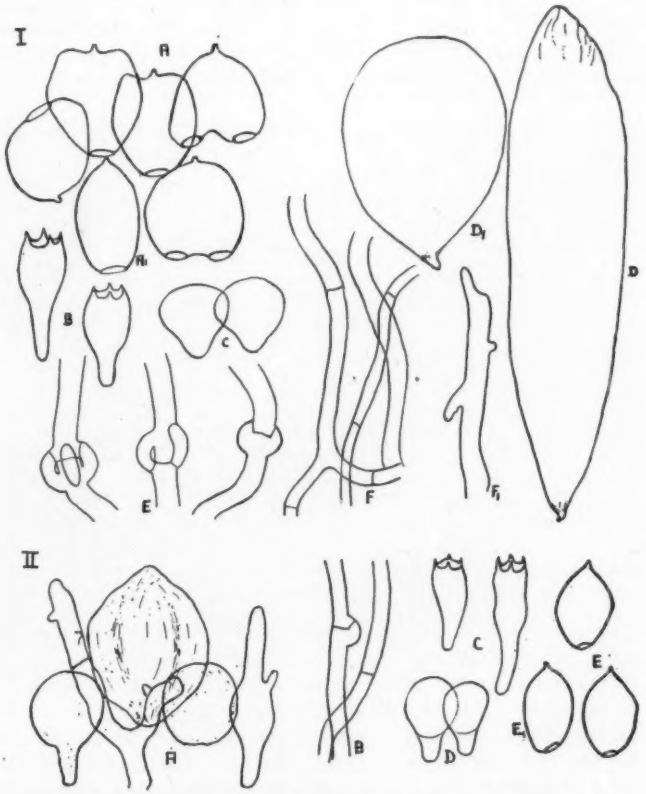
Spores 11.6–14.2 × 7.6–9.5 × 8.3–10 μ, mostly 12.5–13 × 8–9 μ, broadly ovate, usually slightly flattened, some of them obscurely angular in face view, dark umber in H_2O (coal black in KOH), truncate, germ pore conspicuous, slightly eccentric, about 2.5 μ broad. Basidia 4-spored, more or less dimorphic, 30–45 × 10–11 μ, sterigmata 2–3 μ long. Paraphyses pear-shaped. Pleurocystidia 18–30(50) × 15–40 μ, scattered to rare, vesiculose and soon collapsing. (All material raised in culture has been absolutely devoid of pleurocystidia). Edge of gills made up of pear-shaped, subglobose or globose cells, 15–35 μ broad, borne on thorn-like projections on cylindric filaments 3–8 μ broad. Gill trama interwoven, cells about 3–5 μ broad. Veil of cap similar to the tissue of the gill edge but inflated cells averaging somewhat larger (15–80 μ), slightly incrusted, readily collapsing, often with brownish amorphous material between. Clamp connections demonstrated on mycelium (see below) but not in fruitbody.

Habit, habitat and distribution. Fasciculate, in large clusters, on old, decaying haystack. May 21–25, 1947, Arboretum, Ann Arbor, Mich., U. S. A., leg A. H. Smith and M. Lange (Lange *718*, *719*). Previously recorded from France, Switzerland and England.

Observations. The specimens grown *in vitro* show a very prominent veil, which on young buds forms conspicuous warts. Stem and veil both turn brick red a few seconds after being touched and after some minutes fade to vinaceous brown or avellaneous. These characters are more difficult to ascertain on specimens found in nature, but are very striking on those produced in culture.

The peculiar color reaction of the veil and stem gives *C. cothurnatus* some similarity to *C. dilectus* and *C. roseotinctus,* but I do not believe there is any close relationship since these species have another type of veil. *C. cothurnatus* evidently belongs in the group of *C. niveus* and *C. semilanatus* by virtue of similar veil and spore characters, and appears to be very close to the latter, from which the changing color of the veil and differences in shape and size of spore distinguish it. It is not without some doubt that I give this interpretation of *C. cothurnatus,* a species badly treated or ignored in modern literature, but the original description, as given by Saccardo, fits my plant well, except for the mention of the gills turning black through "flesh color." No detailed description of the microscopic characters of *C. cothurnatus* is known to me. Al-

though the plant originally was recorded from cow dung, Martin (1904–05) finds it on humus, in the spring, thus better corresponding—if correctly interpreted—to the present find. I have had no access to Gillet's work (l. c.) but have seen a copy of the illustra-



FIGS. I–II. Microscopic characters of *Coprinus cothurnatus* and *C. myceliocephalus.*

tion (kindly made for me by Dr. J. Favre in Geneva)—it very much recalled the present plant.

Cultural characters. Spores spread on horse dung agar germinate readily in less than 24 hours at 18° C. (almost 100%). Poly-

spored mycelium is provided with clamp connections. Single-spore mycelia were isolated and mated together (TAB. 1). The species, accordingly, is heterothallic and bipolar. Fruitbodies form rather readily about a month after the inoculation both on agar in test tubes and on sterilized horse dung.

TABLE 1

Coprinus cothurnatus GOD. RESULT OF PAIRING OF 10 HAPLOID MYCELIA. + indicates formation of clamp connections and spore producing fruitbodies.

	A	C	D	H	F	E	G	B	I	J
A		−	−	−	+	+	+	+	+	+
C	−		−	−	+	+	+	+	+	+
D	−	−		−	+	+	+	+		
H	−	−	−		+	+	+	+		
F	+	+	+	+		−	−	−		
E	+	+	+	+	−		−	−		
G	+	+	+	+	−	−		−		
B	+	+	+	+	−	−	−		−	−

Coprinus myceliocephalus sp. nov. (FIG. I, IV)

Pileus 0.4–0.8 (2.0) cm. altus, initio globosus, postea ex ovato expansus, velo universali valido, albo, in squamas adpressas lacerato obtectus, sub velo striatus, ex pallide cinnamomeo nigricans. Lamellae liberae, subconfertae, ventricosae, initio albae, dein cinnamomeae, tandem nigrae, marginibus flocculosis, albis. Stipes 4 × 0.2 (12 × 0.3) cm., flocculosus, cavus, albus. Odor et sapor nulli. Sporae (12.5) 14–17 × 10–12.5 (14) × 9–9.5 μ, subcordatae, subangulatae. Pleurocystidia 140–175 × 25–40 μ, cylindrica, saccata. Cheilocystidia 50–150 × 25–40 μ. Basidia tetraspora. Velum universale ex hyphis mycelioideis, 2–8 μ latis contextum. **Typus** (M. Lange C. 88) in Mus. Bot. Hauniensi et in Herb. Univ. Mich. depositum, e fimo vaccinum ex Brewster Co. Texas Americae borealis habito natum aluit M. Lange, 5–5–48.

Pileus 0.4–0.8 cm. high before expanding (in culture up to 2.0 cm. high), nearly globose at first, then ovate, expanding to ± umbonate, with edge recurving and somewhat splitting at maturity. Veil prominent, a thick, white, fibrillose coating, breaking up in adpressed patches during expansion and still conspicuous on deliquescent cap, the larger patches especially on and around the umbo. Surface of cap exposed between patches when expanding, somewhat viscid, watery cinnamon-brown, turning black through grayish brown. Edge of cap fibrillose. Flesh whitish, thin. Lamellae free, moderately crowded, 2–3.5 mm. broad, white at first, soon pale grayish brown, then blackening through ashy gray. Edge prominently white floccose at first, deliquescing from the edge. Spores ripening simultaneously on whole gill. Stipe 4 cm. long, 2 mm. thick (in culture up to 12 × 0.3 cm.), white; young stipe densely clad by a white filamentous coating, when old with

more scattered fibrils; cylindric, slightly tapering above, the base slightly bulbose, with remnants of the velum partiale; hollow, flesh whitish. Odor and taste faint. Sporeprint black.

Spores (12.5)14–17 × 10–12.5(14) × 9–9.5 μ, distinctly flattened, ± angular-subcordate in face view, elliptic in side view, impellucid, nearly black (coal black in KOH); germpore large, apical or nearly so; some few spores deformed, with two germpores. Basidia 4-spored, somewhat dimorphic, broadly clavate, short to long pedicellate, 25–40 × 12–14 μ incl. sterigmata (about

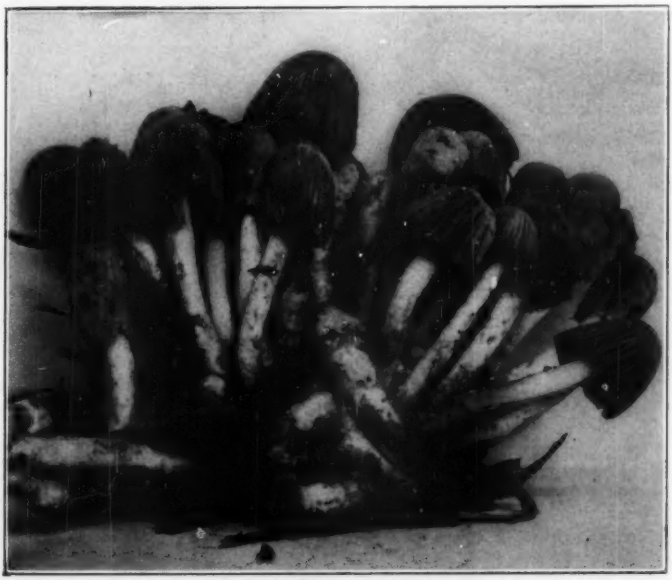


FIG. III. *Coprinus cothurnatus.*

4 μ). Pleurocystidia rather numerous, 140–175 × 25–40 μ, inflated cylindric, sac-shaped, apex broadly rounded to somewhat acuminate, thin-walled, readily collapsing. Cheilocystidia numerous, similar to pleurocystidia or considerably shorter, some being nearly globose, 50–150 × 25–45 μ. Paraphyses broadly pear-shaped. Gill trama not prominent, interwoven, of elongated, somewhat branched cells, generally 5–10 μ broad, some few inflated, much broader. (A section of young bud shows a loosely interwoven tissue between gill edges and stem, of which the cheilocystidia form a part.) Veil on cap made up of interwoven hyphae

of a mycelioid character, 2–8 μ broad. Outer layer of veil in young buds shows a considerable number of narrow but rather thick-walled hyphae. Nuclei are seen mostly in this part of the veil on fixed and stained material. On older caps the veil consists almost exclusively of somewhat wider, more thin-walled and irregularly branched hyphae. The filaments on the stem are made up of shorter hyphae of this latter type. No clamp connections seen in any part of fruitbody, but demonstrated in mycelium (conf. below).

Habit, habitat and distribution. Single, occasionally few together, on dung of cow and goat. Texas, Galapagos Islands.

Material studied. M. Lange C. 88–**type,** developed *in vitro* in laboratory on cow dung from SE. of Santiago Peak, Brewster Co., Texas, U.S.A. May 5, to 11, 1947 (the dung collected April 7, by R. McVaugh); M. Lange C. 36, Cultures obtained from goat dung collected on the Galapagos Islands were furnished through the courtesy of Professor G. W. Martin, Univ. of Iowa, Iowa City, Iowa.

Observations. The description is drawn from specimens which occurred with other Coprini on the moistened dung, and should be considered exactly corresponding to what will be met in nature. Of the Galapagos plant I have seen only specimens raised in pure culture, on sterilized substrate. These differ slightly in average size and shape of spores: 16–18 × 12.5–14.5(15) × 9.5–10 μ, some of them more distinctly angular, and many of them (in some mounts up to 20 per cent) with two germpores; these spores often collapse before maturity and very likely are sterile. I deem this character much too inferior to give the Galapagos plant the rank of a distinct species or variety.

The closest relative previously described in literature seems to be *C. vermiculifer* Joss. (Josserand, **1944**). It has the same type of veil, especially in young stages, and the same type of gills with a floccose edge occasionally splitting. Microscopically the species are easily separated on account of the very different spores and the lack of clamp-connections in the veil tissue. Macroscopically the species must be very hard to distinguish. I have looked for adequate descriptions of similar species from the tropics and subtropics, but the generally very brief diagnoses have not permitted me to identify *C. myceliocephalus* with any of them.

CULTURAL CHARACTERS. The species fruits very readily on horse dung agar as well as on sterilized dung, sometimes as early as 11 days after the inoculation and after the development of a very vigorous white, aerial mycelium. The spores germinate in a very

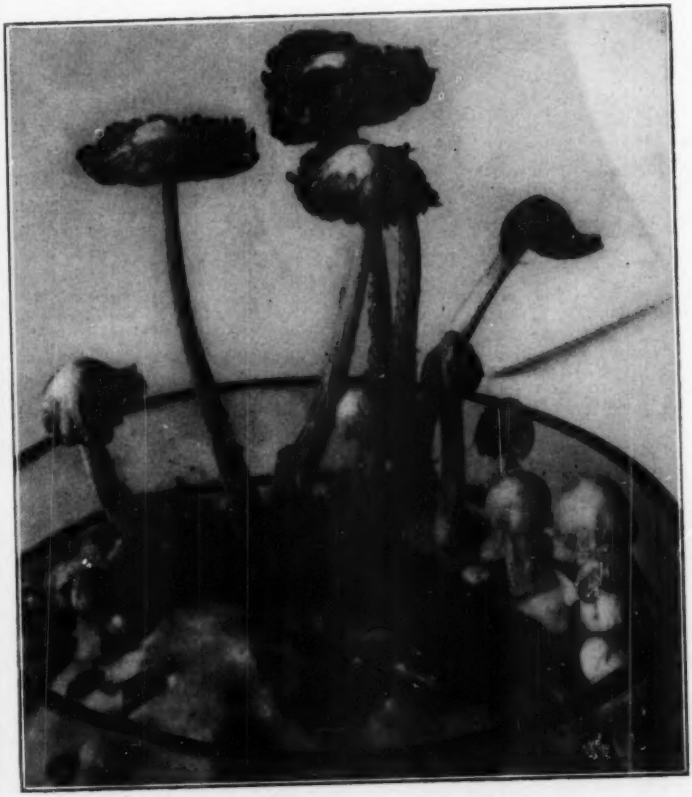


FIG. IV. *Coprinus myceliocephalus.*

low percentage on horse dung agar, generally only 0.01–1 per cent. Several different treatments, namely heating of the spores in juice of dung, addition to the agar of other types and concentrations of dung juice, and of various mineral nutrient, were tried with little or no effect. The germination of spores and development of one

mycelium on an agar-plate seem to stimulate the germination of the neighboring spores, and some young mycelia will generally develop in the outskirts of the older one. The first hyphae grow close to the agar surface, but in a distance of about 2–3 mm. from the germinating spore aerial hyphae develop, some of which are provided with very prominent and well developed clamp-connections, two or three at the same transversal wall (FIG. Ie). As far as I know, this phenomenon, described for instance from *Coniophora,* has not previously been noticed for a species of *Coprinus,* in spite of the thorough study of the cultural characters of this genus. It has been observed as a regular feature of all mycelia studied of this species including the single-spore mycelia, but the clamp-connections seem to occur with a varying frequency from plate to plate. They are most constantly seen on the first aerial hyphae, and never observed on hyphae growing down in the agar. Ten single-spore mycelia were isolated (from both strains). All produced normal fruitbodies, the spores of which gave rise to a second generation. From this it is evident that the species is truly homothallic.

Temperature: Mycelia were placed in constant temperature chambers at different temperatures. As one would expect, knowing the place of the origin of the cultures, the growth was very vigorous at 35° C., slightly slower at 22° C., and at 15° C. nearly zero. Cultures kept at 18° C. will sometimes develop normally, but sometimes stop growing after a while. The lower limit for normal growth thus appears to be about 20° C. and is considerably higher than for Coprini from cooler climates.

Light: The species requires light for normal fruiting. In the dark, long stipes develop with small brownish caps, the veil becomes very much reduced, and these caps never open. They collapse after a while without ripening spores. Some cultures developed no buds at all in the dark.

ACKNOWLEDGMENTS. My work on the Coprini, to which this paper is a first contribution, has been suggested by Dr. A. H. Smith, who most kindly placed a considerable amount of material at my disposal, and gave valuable advice. To the Director of the University of Michigan Herbarium, Dr. E. B. Mains, and also to the directors of the Carlsberg Laboratorium and the Botanical

Laboratorium of the University in Copenhagen, where my culture work was carried out, I owe a debt of thanks for granting me the necessary facilities. The latinizing of the diagnosis is by Tyge Christensen.

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EXPLANATION OF FIGURES

I. *Coprinus myceliocephalus.* A, spores in face view; A_1, spore in side view; B, two basidia; C, two paraphyses; D, pleurocystidia; D_1, short cheilocystidium; E, hyphae from mycelium with triple and double clamp-connections; F, hyphae from veil of young cap; F_1, hyphae from flocci on stem; (A and $A_1 \times 1000$; B–F $\times$ 500.)

II. *Coprinus cothurnatus* God. A, elements from veil on cap; B, mycelium with clamp-connection; C, two basidia; D, two paraphyses; E, two spores in face view; E_1, spore in side view. (A–D $\times$ 500; E and $E_1 \times 1000$.)

MYCOLOGICAL NOTES. IX

C. L. Shear

37. The Genus Venturia and a Proposed Lectotype

De Notaris in his original publication of the genus *Venturia* (Atti Sci. Ital. **6**: 484. 1844) described two species, *V. rosae* and *V. dianthi*. It might naturally be expected that subsequent authors would have based their concept of the genus on one or the other of these species, but this was not the case, the type method of fixing the application of generic names having not yet been proposed. Cesati and de Notaris (Comment. Soc. Crittogam. Ital. **1**: 225. [Reprint p. 51.] 1863) transferred other species to the genus, including *V. dickei* (Berk. & Br.), *V. eres* (Berk. & Br.), *V. macrotrichia* (Berk & Br.), and *V. chaetomium* (Cda.).

Saccardo (Sylloge Fungorum **1**: 586. 1882) took the genus in the sense of Cesati and de Notaris (l. c. 1863) "pro minore parte" rather than as first set up by de Notaris. He noted that the two original species were setose Pleosporas for which at a later date (Syll. Fung. **2**: 285. 1883) he established the genus *Pyrenophora*. In his compilation he included species referred to the genus by Fries, Cooke, Karsten, and others as well as a number added by himself to make up a heterogeneous group of forty species.

In 1886 Berlese and Saccardo (Ann. Soc. Ven. Trent. **10**: 174) proposed a new genus, *Proventuria*, based on the original *Venturia rosae* de N. (*Pyrenophora rosae* [de N.] Sacc.), a study of authentic specimens having shown that the ascospores were uniseptate and brown rather than muriform. The other original species, *V. dianthi*, was renamed *Pyrenophora notarisii* Sacc. (Syll. Fung. **2**: 285. 1883) as already noted.

Since the publication of the Sylloge the general usage of mycologists and phytopathologists has been that of Saccardo. However, even a casual study of the various species included by Saccardo shows that several genera are represented, so that in order to apply the name in a definite manner and to avoid further confusion, the

name should be conserved and typified by a species representing the most general current usage. The best known group of species is that including *V. inaequalis* (Cke.) Wint. and *V. pyrina* Aderh. On account of their great economic importance as the cause of apple and pear scab they have been thoroughly investigated. Their conidial form is *Fusicladium*. Until we have more complete information in regard to many of the other species now included in the genus no satisfactory, complete segregation can be made.

Clements and Shear (The Genera of Fungi, p. 267. 1931) proposed as the type *V. chlorospora* (Ces.) Karst. which Ellis and Everhart (No. Amer. Pyren. p. 138. 1892) noted as a synonym of *V. inaequalis* (Cke.) Wint., although they are now regarded as distinct species. But it is perhaps better to take *V. inaequalis* as the type since it is the more familiar species. Bisby and Mason (Trans. Brit. Myc. Soc. **24**: 172. 1940) state that *Venturia* should be conserved and included in their list of species, *V. aucupariae, V. chlorospora, V. inaequalis,* and *V. pirina.*

In 1923 Sydow (Ann. Myc. **21**: 171) protested the action of Saccardo and Berlese, as mentioned above, in transferring the two original *Venturia* species of de Notaris to other genera and using the name for another group of heterogeneous species. He proposed a new genus, *Spilosticta,* typified by *V. rumicis* (Desm.) Cke. and added a new species, *S. bistortae.* Species of this genus were characterized by buried foliicolous perithecia and an *Ovularia* conidial stage. For the leaf inhabiting species with a *Fusicladium* conidial stage he proposed the genus *Endostigme* to include the following species placed in *Venturia* by Saccardo: *E. inaequalis* (Cke.) (type), *E. ditricha* (Fr.), *E. tremulae* (Aderh.), *E. chlorospora* (Ces.), *E. fraxini* (Aderh.), *E. pirina* (Aderh.), and *E. crataegi* (Aderh.). *Endostigme* would then be an exact synonym of *Venturia* as proposed for conservation and typified by Clements and Shear and Bisby and Mason.

Petrak (Ann. Myc. **38**: 193. 1940) considered Sydow's two genera synonymous and made the new combination *Spilosticta inaequalis* (Cke.) Petr. for the apple scab fungus. Jørstad (Nyt. Mag. Nat. **84**: 251–3. 1943) accepted Sydow's genera *Spilosticta* and *Endostigme* as distinct because of their different conidial stages. For the type species of the latter, however, he proposed to substi-

tute *Sphaerella cinerascens* Fleischhack for *E. inaequalis,* making the new combination *E. cinerascens* (Fleischhack) Jørstad, since he considered *cinerascens* the oldest valid specific name for the apple scab fungus. This action does not appear to be justified for the following reasons:

Jørstad's decision was based on Rabenhorst's use of the name in 1865 for a fungus issued as No. 845 of his exsiccati, the label reading as follows:

Rabenhorst, Fungi europaei.
845. SPHAERELLA CINERASCENS Fckl. Fung. Rhenan. N. 824.
Paraphysibus nullis, ascis tubulosis octosporis, sporis uniseriatis, pulchre chlorinis, uniseptatis, 1/76 mm longis a Sphaerella ditricha Fr., et Sphaerella chlorospora Cesati vix diversa.
In foliis Sorbi ariae legit Arnstadiae (Thuringiae) Majo 1865.
Dr. Fleischhack.

There is nothing here to justify the conclusion that Fleischhack was the author of the description or the name, since Rabenhorst clearly cites Fuckel as the author of the species and Fleischhack as the collector. This error in ascribing the authorship of *Sphaerella cinerascens* to Fleischhack apparently originated with M. C. Cooke (Jour. Bot. **4**: 248. 1866), who included it as a synonym in describing *Sphaerella inaequalis* as a new species common in England on dead leaves of ash, hawthorn, pear, and apple: *"Sphaerella cinerascens,* Fleisch. Rab. Fung. Eur. no. 845 (not *S. cinerascens,* Fuckel, Fung. Rhen. no. 824." This synonymy is accepted on the basis of Cooke's statement since we have been unable to find the fungus itself on the specimen of Rabenhorst, No 845, in the Mycological Collections of the Bureau of Plant Industry. It will be noted that the label on this specimen as cited above credits the binomial *Sphaerella cinerascens* to Fuckel on the basis of a specimen issued in the latter's Fungi Rhenani, No. 824. However, the Fuckel specimen was issued under the name *Sphaeria cinerascens* so that Rabenhorst's usage constitutes a new combination, although it was again cited by Fuckel in 1869 (Symb. Myc. 103) as *Sphaerella cinerascens* Fckl. Both Cooke (l. c.) and Fuckel (l. c.) state that *Sphaerella cinerascens* Fckl. in Rab. Fung. Eur. no. 845 and *Sphaerella* (*Sphaeria*) *cinerascens* Fckl. in Fung. Rhenani no.

824 are different fungi, but this is irrelevant to the present discussion.

After all the specific epithet *cinerascens* is invalid for the apple scab fungus since *Sphaeria cinerascens* Fckl. is a later homonym of *Sphaeria cinerascens* Schw. (Syn. Fung. Am. Bot. p. 225. 1832) described on leaves of *Asclepias*. Cooke transferred this species to *Sphaerella* (Jour. Bot. **21**: 130. 1883) and Saccardo (Syll. Fung. **1**: 31. 1883) considered it a *Laestadia*. With the elimination of *cinerascens, inaequalis,* the epithet most generally used in the extensive literature on the apple scab fungus, remains acceptable. Winter appears to have been the first to make the transfer from *Sphaerella* of Cooke to *Venturia* in 1875, or at least it is credited to him by de Thuemen on the label of his specimen No. 261, Mycotheca universalis. Aderhold (Hedwigia **36**: 81–2. 1897) in his careful studies of a related group of *Venturia* species restricted the name *V. inaequalis* to the fungus on *Malus* and *Pyrus* (other than *P. communis*), drew up an emended description, and credited the combination to himself. A correct citation of the species would appear to be *Venturia inaequalis* (Cke.) Wint. emend. Aderh., as noted by Jørstad (l. c.), which for ordinary usage becomes

VENTURIA INAEQUALIS (Cke.) Wint. apud de Thuemen Myc. Univ. Exsic. no. 261. 1875.

Sphaeria cinerascens Fckl. Fungi Rhen. no. 824. 1863. (non *S. cinerascens* Schw. Syn. Fung. Am. Bot. 225. 1832.)
Sphaerella cinerascens Fckl. apud Rab. Fungi Eur. no. 845. 1865. (non *S. cinerascens* Cke. Jour. Bot. **21**: 130. 1883.)
Sphaerella inaequalis Cke. Jour. Bot. **4**: 248. 1866.
Venturia inaequalis Aderhold Hedwigia **36**: 81–2. 1897.
Didymosphaeria inaequalis Niessl in Rabh. Fung. Eur. Exsic. no. 2663. 1881.
Endostigme inaequalis Syd. Ann. Myc. **21**: 171. 1923.
Spilosticta inaequalis Petr. Ann. Myc. **38**: 193. 1940.
Endostigme cinerascens Jørstad Nytt. Mag. Nat. **84**: 252. 1944.

38. VENTURIA ON ERICACEAE

There is a group of closely related species usually referred to *Venturia,* which are found on leaves of ericaceous plants. They

differ from the type species, *V. inaequalis,* in having superficial perithecia and no known conidia. They appear to be nearer to *Coleroa* Rab. as typified by *C. chaetomium* (Kze.) Rab., which occurs on *Rubus.* Paraphyses are usually uncertain or wanting. *Gibbera,* as typified by *G. vaccinii* Fr., has *Helminthosporium* conidia and paraphyses and does not seem congeneric. The species to be considered are three.

Venturia arctostaphyli Cke. & Hark. Grev. **13**: 20. 1884.

This species was originally described from dead leaves of *Arctostaphylos* collected in California. An examination of part of the type material collected by Harkness on leaves of *A. pumila* shows small superficial perithecia scattered over spots on dead leaves. The surface of the spots has the grayish-white, somewhat glistening appearance common to this group of species. They lose something of this characteristic after infected leaves have fallen and become faded. We find mature spores 15–18 × 5 μ, somewhat larger than the measurements recorded in the description (12–15 × 5 μ). Setae around the summit of the perithecia are from 50–75 μ long. This does not seem to be specifically distinct from the fungus found on *A. uva-ursi* in Massachusetts, although in the eastern form, the setae on the perithecia are only 40–45 μ long and not so numerous. This slight difference, however, could scarcely be considered specific.

Venturia cassandrae Pk. Report N. Y. State Bot. **38**: 104. 1885.

Peck noted that this species caused reddish-brown or brownish spots, sometimes with a grayish center and that the perithecia were minute, broad, black, with a few short, straight, diverging black setae above. He found the fungus on living leaves of *Cassandra calyculata* in New York State. He adds further: "the perithecia sometimes occur on the upper surface of the leaf, but oftener on the lower. They are so small that they are scarcely visible to the naked eye. Sometimes they emerge from beneath the scales of the leaf, and then they appear erumpent, although in reality they are superficial."

Venturia gaultheriae Ell. & Ev. Jour. Myc. **1**: 153. 1885.

The description of this species as taken from Ellis and Everhart's North American Pyrenomycetes follows:

"On orbicular, dark brown, ⅓ mm. spots, which are mostly of a lighter color (gray) in the center. Perithecia scattered, orbicular (75 μ), membranous and rather coarsely cellular, with a few black, continuous, straight, spreading, 35 × 3 μ bristles above. Asci ovate-oblong, 30–35 × 8–11 μ, broader and slightly curved below, sessile, without paraphyses. Sporidia biseriate, subhyaline (with a greenish-yellow tint), ovate-oblong, 3–4-nucleate, uniseptate and slightly constricted at the septum, 11–14 × 3 μ.

"On living leaves of *Gaultheria procumbens,* Newfield, N. J."

From examination and comparison of type material and other authentic specimens we conclude that the three species described above are the same for which the oldest name *V. arctostaphyli* Cke. & Hark. may be used. We have found this species also on *Vaccinium macrocarpon,* the cranberry. Other species closely related and apparently congeneric are *V. pulchella* Cke. & Pk. and *V. kalmiae* Pk., differing from *V. arctostaphyli* in the size of the ascospores, which are 7–10 × 3 μ. Further study of these and other species such as *V. dickei* (Berk. & Br.) Ces. & de N. and *V. myrtilli* Cke. must be made in order to determine whether they deserve generic segregation.

39. VENTURIA CINCINNATA (Fr.) Fr.

Fries (Syst. Myc. **2**: 451. 1823) described *Sphaeria cincinnata,* occurring very rarely on leaves of *Vaccinium oxycoccum.* He later (Summa Veg. Scand. p. 405. 1849) transferred the species to *Venturia.*

Schweinitz (Syn. Fung. Am. Bor. p. 22. 1832) reported the species as occurring on leaves of *Oxycoccus macrocarpus* at Pocono, Pennsylvania. An examination of his specimen, however, indicates that it is not Fries' species, but what was later named by Peck (Rept. N. Y. State Bot. **25**: 106. 1873) as *Venturia compacta* and transferred erroneously by the writer (U. S. Dept. Agric. Tech. Bull. **258**: 13. 1931) to *Gibbera* which has a conidial stage. The above species has none.

Just what species Fries actually had is uncertain. We were unable to find any specimen under this name in his herbarium. Later reports of the species appear to be limited to three: Ellis and Everhart (North Amer. Pyren. p. 142. 1892) record it from Greenland on *Vaccinium palustre;* Rostrup (Bot. Tids. **27**: 35 F. 1906) also reports it from Greenland and on the same host; and there is a specimen in the Mycological Collections of the Bureau of Plant Industry from Bresadola. This is labelled *Venturia cincinnata* (Fr.) Rost. in his own handwriting and with no other data than the statement "Pyrenomycète sur les feuilles d' *Oxycoccos palustris* avec un croquis." The specimen is presumably of European origin. It consists of a number of dead leaves bearing on their lower surfaces perithecia typical of *Acanthorhynchus vaccinii* Shear. The sketch referred to on the label shows the typical short beak of this species with the stiff setae as well as the asci, ascospores and paraphyses characteristic of the species. Measurements given for the ascospores are 30–40 × 12–15 μ. This is clearly not the fungus described by Fries who states that the perithecia of his fungus are entirely superficial, small, subparabolic and sometimes surrounded by curly hairs at the base. In the Bresadola specimen the perithecia are large, subglobose, and completely embedded in the leaf tissue.

No specimens have been seen on *Oxycoccus* or *Vaccinium* which agree with Fries' description. His fungus may be related to the *Venturia arctostaphyli* group, although we have never seen any specimens of this group with perithecia having curly basal hairs nor with conical-cylindrical perithecia. It may really be "sui generis" as Fries says.

40. NOTES ON ANTENNARIA, ANTENNULARIA, AND NIESSLIA

Antennaria as described by Link (In Schrader, Neu. Jour. Bot. **3**: 16, 1809, not Gaert., 1791) was typified by *A. ericophila.* Link described and illustrated only the conidial form of the fungus. Nearly a century later Neger (Centralbl. Bakt. Par. **20** (2): 94. 1907) collected Link's fungus, which originally came from Portugal, in Andalusia on *Erica arborea.* He found perithecia as well as the typical *Antennaria* form of conidiophores described

and illustrated by Link. At an altitude of 200 to 400 meters there was but small growth of subiculum on the smallest branches of the host plant, and especially on the leaf axils and nerves of fallen leaves. This subiculum was small (about the size of a pin-head) and bore perithecia particularly in the leaf axils. The asci were 40–50 × 15–20 μ, united in a mass which is typical of some *Venturia* species; the ascospores were 2-celled, greenish, and 18–20 × 7 μ. At high altitudes, the mycelium of the fungus developed around the axes of the whole plant in dense black mycelial balls, in some instances reaching the size of one's fist. These were easily removed. They absorbed water like a sponge. At about 700 meters these masses developed a peculiar growth of erect *Antennaria* conidiophores 1–2 mm. high, bearing a head of 4-celled dark conidia. The column (saule) of conidiophores was composed of necklace-like hyphae and the interior hyphae bore club-shaped brown conidia, 40–50 μ long. No perithecia were found in these mycelial balls. This, he thinks, was probably due to the greater humidity and rainfall, as well as the colder climate at this altitude. The fungus was not parasitic, he says, but its exclusion of the light and air from the host frequently weakened and killed the plants.

Von Hoehnel (Frag. Myk. no. 379. 1909) discusses *Antennaria* Link and states that nothing certain was known about its identity and relationships until Neger described it as discussed above. After an examination of Neger's specimens von Hoehnel said that he was convinced *Antennaria ericophila* Lk. was identical with *Coleroa straussii* (Sacc. & Roum.) Hoehn. (*Venturia straussii* Sacc. & Roum.), but that no *Antennaria* form of *C. straussii* was known. Further investigation, he said, showed that when mature the perithecia had a distinct ostiole and that conidia were found.

Venturia straussii Sacc. & Roum. (Rev. Myc. **6**: 95. 1884) was based on material collected in 1884 by M. Merlet on *Erica scoparia* near Bordeaux, France, and sent by him to Roumeguère. Saccardo, who received the specimen for study, considered it identical with the fungus described and illustrated by Strauss (in Sturm, Deutschland Flora, Abt. III, Heft **34**: 29–30, Tab. 3, Figs. A–G. 1853) under the name *Chaetomium pusillum* Fr. Strauss' identification, however, was in error, as was indicated by Saccardo's action in setting up a new name for the Merlet specimen.

The original Friesian fungus was referred to *Niesslia* by Schroeter and also named de novo by Albertini and Schweinitz and Corda as the following partial synonymy will show. This species occurring on pine needles should not be confused with the two species on Ericaceous hosts discussed hereafter.

NIESSLIA PUSILLA (Fr.) Schroet., in Cohn, Krypt. Fl. Schl. **3**: 294. 1893.

Sphaeria exilis Alb. & Schw. Conspect. Fung. 44. 1805.
Chaetomium pusillum Fr. Syst. Myc. **3**: 255. 1829.
Sphaeria chaetomium Corda Icones II, 29. 1838.
Venturia chaetomium Ces. & de N. Schema Class. Sfer. Ital. 225. 1863.
Niesslia chaetomium Auers. in Gonnerman Rab. Mycol. Eur. Heft V & VI 30. 1869.
Niesslia exilis Wint. in Rab. Krypt.-Fl. 2 Aufl., 1 Bd., II Abt. 196. 1885.

The fungus described and illustrated by Strauss (l. c.) was found on living leaves of *Erica carnea* near Munich. No type material is known. There is little doubt, however, that *Venturia straussii* Sacc. and Roum. is the same and that as von Hoehnel states it is the same as *Antennaria ericophila* (Lk.) Neger.

The name *Antennaria* Link being untenable because of an earlier use of the name for a phanerogamic plant by Gaertner (1791), Reichenbach in 1828 (Consp. Reg. Veg. p. 5) proposed *Antennularia* as a substitute. This was also invalid for an ascogenous fungus until the perithecial form was found and described by Neger and adopted by von Hoehnel as discussed above. We regard the genus *Antennularia* (Reich.) Hoehn. as having been validated by von Hoehnel (Frag. Myk. 379. 1909) when he described Neger's specimens of *Antennaria ericophila* Lk., which showed conidia, perithecia, and ascospores, and adopted Reichenbach's name for the fungus.

He added three other species to the genus in addition to the type, *A. ericophila* (Lk.) Hoehn., among them being *A. salisburgensis* (Niessl) Hoehn. The original material upon which the description of this latter species was based was distributed in 1886 as no. *3550* in Rabenhorst—Winter's Fungi Europaei Exsiccati. After comparing specimens of this number with the original material of *Venturia straussii* Sacc. & Roum. (*Antennularia ericophila* (Lk.)

Hoehn.) issued by Roumeguère as no. *2828* of his Fungi Gallici Exsiccati and other specimens of the same collection issued as no. *3142* of Rabenhorst—Winter's Fungi Europaei, we are of the opinion that the two are different species. Von Hoehnel (Frag. Myk. no. 115. 1907) came to the same conclusion after studying specimens of the same numbers. The chief difference is that in *A. ericophila* the perithecia form dense masses in the axils of the leaves and on the stems whereas in the second species they appear to be confined to the leaves. The ascospores in the first are shorter and broader (15–18 × 6–8 μ) than in the second (18–21 × 5–6 μ).

Von Hoehnel has added two other species to this genus, *A. engleriana* (P. Henn.) Hoehn. (Frag. Myk. no. 356. 1909) based on *Dimerosporiopsis englerianus* P. Henn. and *A. rhododendri* Hoehn. based on the ascogenous form of *Torula rhododendri* Kunze. We have seen no authentic specimens of either of these and therefore can express no opinion regarding them. The synonymy of the two species which we have studied is as follows:

ANTENNULARIA ERICOPHILA (Neger) Hoehn. Sitzungsb. Akad. Wiss. Wien. 118, abt. **1**: 1198. 1909.

Antennaria ericophila Lk. in Schrader Neues Jour. Bot. **3**: 16. 1809.
Venturia straussii Sacc. & Roum. Rev. Myc. **6**: 95. 1884.
Antennaria ericophila Neger, Centralbl. Bakt. **20** (2): 94. 1897.
Coleroa straussii Hoehn. Sitzungsb. Akad. Wiss. Wien 116, Abt. **1**: 115. 1907.

Exsiccati specimens examined: Roumeguère, Fungi Gallici exs., no. *2828*, as *Venturia straussii* Sacc. & Roum.; Rabenhorst—Winter Fungi Europaei, no. *3142*, as *V. Straussii* Sacc. & Roum.

ANTENNULARIA SALISBURGENSIS (Niesel) Hoehn. Oesterr. Bot. Zeit. **63**: 233. 1913.

Chaetomium pusillum Strauss in Sturm, Deutschland Flora, Abt. III, Heft **34**: 29–30. 1853, non Fr. 1829.
Gibbera salisburgensis Niessl Hedw. **26**: 33. 1887.
Eriosphaeria salisburgensis Neger Ber. Deutsch. Bot. Gesell. **19**: 471. 1901.
Coleroa salisburgensis Hoehn. Sitzungsb. Akad. Wiss. Wien 116, Abt. **1**: 115. 1907.
Gibbera straussii Zahlb. Krypt. Exs. Mus. Pal. Vind., no. *824*.

Exsiccati specimens examined: Jaap, Fungi Sel. Exs., no. *614*, as *Antennaria salisburgensis* (Niessl) Hoehn.; Zahlbruckner, Krypt. Exs. Mus. Pal. Vind., no. *824*, as *Gibbera straussii* Zahlb.; Rabenhorst–Winter, Fungi Europ. Exs., no. *3550*, as *Gibbera salisburgensis* (Niessl) Hoehn.; Rehm, Ascom. Exs., no. *1939*, as *Coleroa salisburgensis* (Niessl) Hoehn.

The fungus issued by Jaap (Fungi Sel. Exsic. no. *657*) as *Antennaria salisburgensis* (Niessl) Hoehn. associated with the aphid, *Eriococcus ericae*, on *Erica tetralix* is doubtfully the same as his no. *614*. It has perithecia with the short, stiff setae and the colored ascospores of the same size and shape as the other specimen, but the perithecia occur on the stems as well as on the leaves and show more of the long basal hyphae, which seem to have grown over some of the aphids. It will be necessary to learn more in regard to the relation between the aphids and this and related species of these fungi, especially *Antennularia ericophila*, before a final decision is possible.

A further specimen found in the Mycological Collections of the Bureau of Plant Industry should be considered here. It was issued by C. Torrend as no. *146* of his Fungi Selecti Exsiccati and is labelled "*Gibbera salisburgensis* Niessl, ad folia *Ericae arboreae*, Madère, C. de Menzes, VI–1912." It consists of a few leaves bearing on the under side small dense groups of perithecia without subiculum, appendages, or setae. The perithecia are slightly rough or minutely verrucose. The perithecial wall is much thicker than in the other species mentioned, but paraphyses, asci, and ascospores are typical. The spores are 15–20 × 6–8 μ. This is not Niessl's species. It would seem to indicate that there may be another group of species without subiculum or setae, but otherwise alike.

Neger (Ber. Deutsch. Bot. Gesell. **19**: 471. 1901) after examining the Rabenhorst–Winter specimen (no. *3550*) of *Gibbera salisburgensis* collected the fungus himself on *Erica carnea*. His material agreed exactly with the other. He described it in detail and showed a leaf section which indicated that a dense mass of vegetative hyphae developed beneath the thin epidermis of the upper leaf surface from which the superficial subiculum and perithecia arose. Infection took place in the summer and perithecia formed the following year. He maintained that the fungus was not a

Gibbera and transferred it to *Eriosphaeria*, as *E. salisburgensis* (Niessl) Neger.

There has just come to our attention Petrak's paper "Über *Gibbera* Fr. und verwandte Gattungen" (Sydowia **1**: 169–201. 1947) in which he revises the genus *Gibbera* with *G. vaccinii* Fr. as the type and includes *Antennularia* as a subgenus. He does not include the production of conidia as a generic character. We regard this as a character of sufficient importance to exclude such species as *Venturia compacta* and other superficial species having no conidia.

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MYCOLOGIA

FINANCIAL STATEMENT

(July 1, 1947–June 30, 1948)

Unexpended reserve, July 1, 1947		$ 4,924.05
Current receipts (joint funds):		
Mycological Society (members' subscriptions)	$1,864.00	
Subscriptions	3,477.80	
Sale of back sets (vol. 25 and later)	824.35	
Payments for excess paging	388.52	
Special funds:		
Sale of back sets (vols. 1–24) and index	415.80	
Interest on endowment	583.00	
	$ 998.80	
Total receipts		$ 7,553.47
Total on hand		$12,477.52
Cost of printing and distribution:		
Printing, binding, mailing 6 issues	$4,787.44	
Engraving	1,209.73	
	$5,997.17	
Replacing exhausted issues	524.82	
Miscellaneous office expenses	274.84	
Total cost		$ 6,796.83
Balance		$ 5,680.69
Transferred to endowment fund		$ 1,000.00
Unexpended reserve, June 30, 1948		$ 4,680.69
Endowment fund		14,000.00
Total on hand		$18,680.69

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